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THE UNIVERSITY OF ALBERTA

PSYCHOMOTOR SKILL ACQUISITION IN NURSING: INTRAMUSCULAR INJECTIONS

by

© RENE A. DAY

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE
OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF EDUCATIONAL PSYCHOLOGY

EDMONTON, ALBERTA

SPRING, 1986

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Rene A. Day
(Signed)

PERMANENT ADDRESS:
3523 - 112A Street
Edmonton, Alberta
T6J 1J6

DATED: March 24, 1986

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled PSYCHOMOTOR SKILL ACQUISITION IN NURSING: IM INJECTIONS submitted by RENE ANN DAY in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY in EDUCATIONAL PSYCHOLOGY.

RH Short

Supervisor

Jannetta MacPhail

Murray W. Smith

Ann M. Gothler

External Examiner

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ABSTRACT

Few studies can be found in the nursing literature that describe the acquisition of psychomotor skills. This lack may be due, in part, to a shift in the focus of nursing curricula from emphasis on psychomotor proficiency to more cognitive aspects.

This study was designed to examine in detail the learning of one important skill in nursing, that of intramuscular injections (IM's). The volunteer subjects were 48 female students, aged 18 to 32, in the second year of a baccalaureate nursing program.

Both qualitative and quantitative methods of data collection and data analysis were used. Data were collected in several ways: participant observation with varying degrees of involvement (complete observer of the lecture, and participant-as-observer in the laboratory practice session); semi-structured interviews before, during, and at the conclusion of the study (including a description of phases of learning, strategies used, feelings about injections, and evaluation of teaching strategies); measurement of anxiety (State-Trait Anxiety Inventory and Form B); manipulative dexterity (subtests of the General Assessment Test Battery); self-esteem (Culture-Free Self-Esteem Inventory for Adults); self-efficacy (Form A); knowledge (knowledge test); and performance scores for preparing and administering three IM injections to patients (Intramuscular Injection Observation Sheet); age; and academic achievement (grades). Descriptive statistics, correlations, and analysis of variance techniques were employed. The qualitative data were examined and categorized. Frequency and percentage distributions were used to summarize the data.

The older students in the study were slightly less anxious about the injections and demonstrated higher dexterity scores. For all students, with each successive injection the level of anxiety decreased, whereas the self-efficacy and performance scores increased. Although the most anxious students took longer to prepare each injection, they achieved higher performance scores. General self-esteem scores indicated a "high" level of self-esteem, but group and individual scores for personal self-esteem were lower. Performance was not significantly affected by age, dexterity, self-esteem, self-efficacy, knowledge, or academic achievement.

Students initially were concerned with being anxious about the injections (14.18% of all responses), and with causing pain (11.48%). Later, the concerns involved locating the correct sites for the injections (24.32%), and calculating dosages (8.16%). With children, the students took longer to prepare and administer the injections, and expressed concern about the reaction of children to injections.

As the students progressed through the injection experience, their focus changed from the procedure and themselves to being more focused upon the patient. The main strategies used by the students in learning to give IM injections were Review (52%) which consisted mainly of mental practice-visualization and/or verbalization and review of printed material, and Practice activities (22.67%) which included simulated and actual experiences.

The teaching strategies of lecture, videotaped demonstration, simulations, and injecting a peer were evaluated positively by the students. Students requested the opportunity to locate all the IM injection sites and to give more injections to each other (73.73% of the responses).

Triangulation or the combined use of qualitative and quantitative methods contributed greatly to the richness of data about the experience of learning to prepare and administer intramuscular injections.

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CHAPTER 1

Overview of the Study

Introduction

During the past few years, the focus in nursing education has "slowly shifted from a clear emphasis on manual performance to broader applications of cognitive skills" (Sweeney, Hedstrom & O'Malley, 1980). Although psychomotor skills are only one component of nursing care, they are important in that if they are performed poorly, the nurse-patient relationship may be adversely affected. Partridge (1978) speaks out on behalf of "a neglected and unpopular element of nursing: technical skills. Wittingly or unwittingly, we have demeaned and classified as 'lower level' these elements of nursing practice which involve manual skills" (p. 358). Singer (1980) notes that North American culture places a heavy emphasis on the mastery of intellectual activities and thus assigns skill mastery a lower prestige level.

Partridge (1978) raises an important question: "Isn't it within the grasp of nursing education to assure minimum competence in the basic skills of our profession and at the same time develop the clinical judgment and intellectual processes that are also required?" (p. 358). Attention must be directed to how psychomotor skills are taught in nursing, and to how nursing students actually learn to perform the necessary skills, in order that graduates of any nursing program are indeed technically competent to practice.

Statement of the Problem

How do nursing students learn complex psychomotor skills such as giving intramuscular injections? Nursing educators interested in psychomotor skill learning have, through experience and trial and error, attempted to discover techniques that are effective in assisting students with skill acquisition. As well, a number of observations have been made in relation to the difficulties and successes experienced by students learning particular psychomotor skills. It is readily apparent that students learn at different rates (Fuller & Denehy, 1975). Some are able to move smoothly and confidently, while others shake and fumble with the equipment. Some may be able to perform the skill competently after only a few practices, while others must repeat the task many times, and even then, may not attain the same degree of proficiency.

As budget constraints result in instructors supervising larger and larger groups of students, it becomes more difficult to provide enough individual instruction time to those students experiencing difficulty with psychomotor skill learning. The problems associated with teaching nursing skills are summarized by Rhode, Kauchak and Eggen, 1980.

> One of the major prob~~lems facing n~~urse ... educators today is how to teach the motor skills necessary for ... [nursing] practice in a manner that is efficient in terms of faculty teaching time, provides for maximum skill acquisition in terms of safety and accuracy of performance in the shortest period of time, allows the student to make the most of limited clinical experiences, minimizes student anxiety, and frees the student to move on to learning the complexities of management of patient care. (Rhode, Kauchak, & Eggen, 1980, p. 27)

For many nursing students the giving of an injection is equated with being a nurse. In addition, successful practice of nursing in a variety of settings will require the giving of injections. In a study of new staff members Boyd and Conrad reported that 64% of college prepared nurses, 16% of university prepared nurses, and 27% of hospital prepared nurses rated themselves as unable to give injections to the specified level (1981, p. 101). While it might be expected that graduate nurses with no experience would report being unable to give injections (54%), it was surprising to find that 26% of those with one or two years experience and 35% of those with three to five years experience also reported being unable to perform injections satisfactorily (Boyd & Conrad, p. 81). Since the results were based on the indivdiual nurse's perception of how well he/she could give an injection and not an actual measurement of performance, it may be that certain concerns, thoughts, and feelings related to giving injections may have negatively influenced the perception of ability to give injections. Despite these possible explanations, the need exists to examine more closely the process of learning to perform IM injections.

Purpose of the Study

The purpose of the study was to describe how nursing students learn and perform a particular psychomotor skill, that of intramuscular injections (IM's).

The first objective was to describe, from the students' viewpoint, the experience of learning how to prepare and give IM injections. The second objective was to identify the actual phases of skill acquisition, beginning with when students were introduced to intramuscular injections, and ending with the actual performance of a minimum of three injections. The third objective was to identify various strategies used by nursing students while learning to prepare and administer IM injections. Data were collected to determine if anxiety, manipulative dexterity, self-esteem, self-efficacy, and knowledge of asepsis and IM's affected the performance of preparing and administering intramuscular injections. This was the fourth objective. The fifth objective was to examine the relationship of age, grade point average, grade in a surgical-pediatric course, and the grade achieved in a practical examination in physical assessment, to the performance of IM injections.

The final objective was to use student descriptions to evaluate the effectiveness of the teaching strategies used in teaching IM injections.

Research Questions

Several questions have been posed which examine issues related to psychomotor skill learning in nursing.

1. What, if any, phases are involved in the learning of IM injections?
2. What, if any, strategies do nursing students use in learning IM injections?
3. How does the level of manipulative dexterity affect performance of IM injections?
4. What effect does anxiety have on the performance of IM injections?
5. What effect does self-esteem have on the performance of IM injections?
6. What effect does self-efficacy have on the performance of IM injections?
7. Does age affect the performance of IM injections?
8. Is there a relationship between academic achievement and the ability to perform IM injections?

Significance of the Study

Providing nursing care to patients involves competence in both intellectual and psychomotor skills. Elliott, Jillings, and Thorne (1982) contend that psychomotor skill learning has been given the lowest priority due to the need to emphasize other content such as leadership, health promotion, and problem solving skills. Attempts by educators to decrease the importance of psychomotor skills have met with failure, since nursing students continue to "place a priority on the mastery of motor skills" (Hanson, 1977, p. 75). Students rank technical competence so highly because incompetence is readily apparent to instructors, to the patient, and to the students themselves (Hanson, 1977). Eaton and Davis (1972) point out that "the level of competence of students or novice nurses is often judged by the degree to which they can smoothly and efficiently perform nursing procedures" (p. 58). In a study conducted by Shields (1952), graduate nurses employed in a variety of agencies selected manual skills as the first ability that a graduate should possess. Bailey (1956) reported that head nurses and instructors selected manipulative skills and technical competence as the most important behaviors. Hurd (1978) maintains that graduates must possess skill competence as well as confidence in their ability to perform psychomotor skills. The nursing service settings are aware that new graduates display deficiencies in technical skills, and often take this into account when planning orientation programs (Atwood, 1979).

In a study to identify difficulties experienced by new nursing staff in performing nursing skills, Boyd and Conrad (1981) recommended that "Faculties of Nursing strengthen the skills preparation of their students so that new graduates are able to function at a basic level of competence" (p. 119). It was further recommended that Faculties of Nursing recognize

> that nursing indeed is a clinically based profession and the ability to perform manual skills while caring for the patient is mandatory for safe and effective nursing care and also to maintain the credibility of the nursing profession (Boyd & Conrad, 1981, p. 120).

Several authors have addressed the need for directing more attention to skill learning by suggesting that students be provided with time, or perhaps even a course, at the beginning of a nursing program, to master the basic psychomotor skills (Hanson, 1977; Rhode, Kauchak & Eggen, 1980; Bauman, Cook & Larson, 1981). Hanson (1977) and Rhode et al. (1980) contend that once students have mastered the manual nursing skills, they will be ready to develop the intellectual skills required in beginning to learn the management of complex patient care.

Elliott et al. (1982) noted that the educational literature contains considerable information on the application of learning theory to the acquisition of psychomotor skills. Additional examples can be found in physical education, physiotherapy, aviation, dentistry, and industry. The nursing literature, on the whole, has neglected to make use of learning theory, and instead, the focus has been on the number and nature of the skills to be included, and the use of some learning aids (Elliott, et al., 1982, p. 26).

This study was designed to attempt to bridge the gap between the knowledge of learning theories drawn from other disciplines, and the teaching of a specific psychomotor skill (intramuscular injection) in nursing. The study began with descriptions from the learners themselves as to the experience of learning IM injections, and included the phases of skill learning and the strategies they were using to assist in learning this skill. By identifying the phases and the strategies used, it may be possible to diagnose the problem areas and then to prescribe appropriate remedial activities. A further result might be that based on certain characteristics (age, level of manipulative dexterity, level of self-esteem, level of self-efficacy, and anxiety) of the learner, specific teaching strategies could be developed to better assist each student in learning the skill.

Definition of Terms

Psychomotor Skills. Harrow (1972) has separated the term "psychomotor" into its two component parts, psycho and motor, and concluded that "it connotes mind-movement or voluntary motion: (p. 31). Spaeth-Arnold (1981) indicated that within the area of motor learning, the term 'skill' is often used to refer to the act or task being performed. The term can also be used in a qualitative way to describe the manner in which an activity is performed. Higgins and Spaeth (1972) considered two aspects of skilled performance: the result of the movement (attainment of the goal) and the movement itself (such as co-ordination, timing, and efficiency) (cited in Spaeth-Arnold, 1981, p. 28). Singer (1980) describes four aspects of a skill that must be sufficiently developed if the performer is to be described as skilled. These aspects can be stated as a formula: "Skill = speed x accuracy x form x adaptability" (p. 30). Speed is important since there is usually a limited time in which the skill is to be performed. Accuracy determines how successfully the acts are carried out. Form suggests that a minimal amount of energy is expended and that the performance "looks good". A skilled performer can adapt, remaining proficient under a variety of changing and unpredictable conditions. Singer concludes his discussion by defining skill as the "consistent degree of success in achieving an objective with efficiency and effectiveness" (p. 31). Klausmeir and Ripple (1971) define a skill operationally as "the level of proficiency attained in carrying out sequences of action in a consistent way" (p. 477).

> Thus a skilled performance, in comparison with one less skilled, is accomplished with (1) less attention to specific movements, (2) better differentiation of cues, (3) more rapid feedback and correction of movements, (4) greater speed and coordination, (5) greater stability under a variety of environmental conditions.
>
> The excellent typist, in comparison with the beginner, gives little or no conscious attention to hand and finger movements, simultaneously hears or sees more relevant cues to guide sequential movements and ignores the irrelevant, responds more quickly to internal and external sources of information concerning the typing movements, moves rapidly in a rhythmic, unbroken pattern, and types consistently under a variety of environmental circumstances. (Klausmeir & Ripple, 1971, p. 477-478)

Robb (1972) restricts her definition of skill to the outcome of the motor act while ignoring the quality of the movement. In most skills, the goal is to bring about a particular outcome, but for some skills such as gymnastics, the form is of considerable importance and actually constitutes the goal.

For the purpose of this study a psychomotor skill will be defined as an action having both cognitive and motor components. The performer of such an action will be described as skilled or skillful if the action is done quickly, accurately, and efficiently, and can be adapted to changing circumstances.

Performance. Performance can be thought of as "observable behavior" and is "operationally defined by the behavior which is of interest to the observer" (Magill, 1980, p. 31). Marteniuk (1979) has described performance as a "level of skill execution that may or may not reflect the true level of skill acquisition" (p. 197). Many factors such as fatigue, boredom, motivation, and how practice is distributed, may affect performance (Marteniuk, 1979).

Learning. Learning is generally described as a "permanent change in behavior, brought about through practice" (Marteniuk, 1979, p. 197). Deese and Hulse (1967) have modified this definition by emphasizing that it is not just the change in behavior that is important, but rather, it is that the change is in a particular direction, brought about by the performance moving closer towards an established criterion. Sparrow (1983) agrees since he sees learning as "a gradual refinement of limb movements toward the biochemical optimum, where the 'optimum' is defined as that movement pattern which minimizes the total work done in achieving the goal of the task" (p. 239). Magill (1980) cautions that learning cannot be observed directly and that inferences about learning are made on the basis of a person's behavior or performance. Two characteristics of performance are indicators that learning has occurred: the performance of the skill has improved with practice over a period of time and the performance shows less variability or fluctuation over time (Magill, 1980, p. 31).

Intramuscular Injections. One particular psychomotor skill in nursing, that of intramuscular injections, involves the drawing up of medication (from a vial or ampule) into a needle and syringe and the injecting of the medication into the muscle of a live person. Care must be taken to locate an appropriate site in a specific muscle (termed landmarking), thus ensuring that underlying nerves and blood vessels are avoided. Principles regarding asepsis (sterile technique) and the administration of medications must be followed throughout the procedure in order that patient safety is assured.

Organization of the Thesis

This thesis is organized into five chapters. The first three chapters comprise the overview of the study, a review of the literature related to psychomotor skill learning, and a description of the research methodology. In chapter four the analysis of the data and the discussion of the findings are presented. In the fifth and final chapter conclusions are drawn, implications for nursing education are suggested and recommendations are made for future study.

CHAPTER II

Review of the Related Literature and Research

Theories and Models of Psychomotor Learning

In the early study of movement behavior, the Stimulus-Response reinforcement view of learning was in vogue. At that time, physiologists focused on "spinal" activity. This led to the idea that motor behavior was identified "with the lower senses and [was] remote from the upper reaches of the mind" (Adams, 1976, p. 89). The use of the term "motor" behavior or "motor" learning "...implies muscular movement, as if reflexive or with little cognitive and perceptual involvement" (Singer, 1980, p. 12). There then came the realization that a considerable amount of cognitive activity was actually involved in motor learning. It was noted that motor sequences are under verbal control, particularly at the onset of learning (Adams, 1976). Singer believes that by placing something in front of the word "motor" such as "psycho" or "perceptual", the true nature of the behaviors is more adequately explained (1980, p. 12).

A Three Level Theory of Perceptual-Motor Behavior. Cratty's theory suggests that many variables that influence a motor performance can be grouped into three main subdivisions (1973, p. 35). The first level (basic behavioral supports), includes such characteristics as level of aspiration, level of persistence, level of arousal/motivation, ability to analyze the mechanics of the task, and various perceptual abilities. The second level (ability traits and personal tendencies), refers to ability traits such as strength, endurance, flexibility, movement speed, reaction time, balance, coordination, and manual abilities. The third level describes variables unique to the performance situation. Examples are: aspects of the physical environment (temperature, humidity, wind), the emotional environment (how the performer feels about his performance, number and reaction of spectators), the amount and recency of practice, instructions before and during the performance, and how motivated the individual feels about doing the specific task (Cratty, 1973, p. 35-36). The variables within the three levels are not independent of each other; information regarding the quality of the performance is fed back to influence the general aspiration level, which in turn may lead to more practice and improvement in the quality of ability traits (Cratty, 1973, p. 36).

A Closed-Loop Theory of Motor Learning. Arising out of his doubts about the usefulness of an open-loop system of behavior in which there was no mechanism for error regulation, Adams (1971) developed his closed-loop theory of motor learning. The main elements of this theory are feedback, error detection, and error correction. "There is a reference that specifies the desired value for the system, and the output of the system is fed back and compared to the reference for error detection and if necessary, corrected" (Adams, 1971, p. 116). In order to learn a movement, the reference mechanism or perceptual trace must be acquired. As a movement proceeds, the feedback is compared with the perceptual trace, and the appropriateness of the movement is assessed. If they match, then the error signal is zero, and the learner carries on with the movement. However, if there is an error, the learner loses confidence in the correctness of the movement and moves to eliminate the error. The learner makes use of both the perceptual trace (stored information about past movements) and the knowledge of results (adequacy of the last movement made) in determining ways to make the next move a better one (Adams, 1976, p. 91). With repeated practice, learning occurs.

Schema Theory. Schmidt (1974) expressed three concerns regarding existing theories of movement (p. 38). He was dissatisfied with Adams' closed-loop theory since it seemed to explain only slow, graded, linear positioning responses and left out ballistic movements. In addition, the theory did not account for the fact that an individual could produce movement that he/she had never done before (novel movement). If the movement had never been performed before, how could it be compared in memory (perceptual trace) for correctness? This then led to another problem, that of storage. If each movement and its reference of correctness must be stored in memory, an infinite capacity in memory would be required.

Schmidt (1974) introduced his schema theory in an attempt to solve these problems. He has assumed that movement is carried out by a "generalized" program, and that the learner chooses the specifications such as speed, force, or the plane of the movement that determine how the program will be run off (p. 38). In this theory Schmidt has postulated two schemata: response production (recall), and response evaluation. In response production he has stated that each time the learner produces a movement, four things are stored: the response specifications needed to run the program; the sensory consequences or feedback; the initial environmental conditions such as orientation in space, size and weight of objects; and most importantly, the outcome of the movement, or what happened in the environment (p. 39). After many movements the learner "abstracts a relationship between the initial conditions, the response specifications, and the outcome of the movement" (Schmidt, 1974, p. 39). Schema theory can be described as being open-looped, with the major focus being on the role of the motor program. Learning, according to Schmidt (1974) is viewed as "the generation of 'bigger and better' motor programs that carry out movement without the need for feedback modification during movement" (p. 40). Errors are seen as just another movement, and actually strengthen the schema. Schema theory predicts that the more variability in the initial environmental conditions and in the outcomes that are produced, the more proficient the learner will be at performing a novel task of a similar class (Schmidt, 1974).

Schmidt's theory has made two major contributions to the understanding of motor skill learning (Kerr, 1982). It has answered the problems of how learners performing an open skill are able to produce novel responses generated from previously established schema. In addition, it allows motor skill learning to fit into the overall developmental model of Piaget.

Information Processing Models. In an attempt to move away from product-oriented views of skill acquisition (outcome of the movement), attention has been directed to more cognitive models such as information processing. In these models, cognition consists of three components: input processing, storage, and output (Ellis & Hunt, 1983, p. 9). The works of Broadbent (1958) and Welford (1968) in particular have contributed to our understanding of the processes involved in human cognitive functioning. When information processing models are applied to motor skill learning, the learner is seen as an active processor in the planning and processing of the details necessary for skill acquisition (Turpin, 1982, p. 77).

Motor skills can be thought of as a series of information processing tasks. The first task is to establish the goal or purpose for the skill performance (Gentile, 1972). The learner then actively selects and attends to data obtained by the senses (sensory input). Central processing involves the evaluation of the environment (perceptual mechanism), decision-making regarding the nature of the response of a broad plan of action (translation mechanism), and the organization of the motor response that will lead to goal attainment (effector mechanism) (Welford, 1968). After the response is executed, feedback related to the characteristics of the movement and the outcome of the response lead to a decision of whether to alter the next response or to repeat it exactly as before. This feedback re-enters the information processing system and the sequence begins again. The performer stores both the motor program and the evaluation of the effectiveness of the response in long term memory where the information remains potentially accessible for future use (Spaeth-Arnold, 1981, p. 45).

Stallings (1976) has indicated that information processing models provide a needed framework for organizing, analyzing, and applying research findings. She also has stated that they provide a viable alternative to

Stimulus-Response theories which have been unable to adequately explain the rapidly growing body of knowledge of motor skill learning.

A Conceptual Model of Motor Behavior. Singer (1975) has proposed a model that combines features from information processing, cybernetic, and adaptive models in order to more adequately describe motor behavior. The model describes the "complex sequential and parallel cognitive operations a learner uses to acquire, to select, and to execute a motor response" (Singer, Gerson, & Ridsdale, 1978, p. 61).

Information enters the system and may be held for a short time in the sensory stores. If no further processing is needed in order for a response to occur, then the stimulus is detected by the perceptual mechanism before being forwarded deeper. However, if more processing is required, the inputs are sent to long term storage to make contact with prior stored representations, and to establish how important the input is (pertinence value). The pertinence value prepares the perceptual mechanism to expect to receive information in a "sequential, priority order, based on the degree of familiarity acquired during contact with the LTS [long term stores]" (Singer et al., 1978, p. 62). The inputs are sent to short term storage where all active processing occurs. Here the learner can rehearse information, search and retrieve additional information from long term stores, decide about movement, and can select the appropriate motor program for meeting the goal. The capacity of short term stores is limited, however, and too much processing may overload the system. Next, messages are sent to the muscles to perform the movement sequences. Feedback is received from proprioception or other sensory organs as the performance progresses. Feedback is used to update the stored knowledge, to attribute causes or reasons for performance outcomes and to determine future performance expectations, to alter emotional state, and to alter the selection of subsequent motor programs (Singer et al., 1978, p. 63).

Once a goal has been met, the learner stores the relevant information in long term stores, thus increasing the existing knowledge base. This information can then be used in determining pertinence values, as a reference point for comparison for detecting errors, and as a base from which to make future expectation statements.

The Dreyfus Model of Skill Acquisition. Dreyfus and Dreyfus (1980) have developed a model of skill acquisition based on their work with chess players and airline pilots (cited in Benner, 1984). The model describes how learners progress through five levels of proficiency as they acquire and develop particular skills (Benner, 1984). The five levels are: novice, advanced beginner, competent, proficient, and expert. As the learner becomes more skilled, there are changes in three general aspects of skilled performance. The first change is a move from relying on abstract principles or rules to the use of past experiences. The second change involves an alteration in how the learner perceives the situation. The situation is no longer viewed as being made up of a number of equally relevant parts, but instead is seen as a complete whole, with only certain relevant parts. In the final change, the learner moves from being outside the situation, to being an "involved performer" (Benner, 1984, p. 13). These changes are reflected in the descriptions of the five proficiency levels (Benner, 1982).

At the novice level, the beginner has no experience, and must depend on rules to guide actions. The beginner is unable to determine which parts of the task are important, or when an exception to the rule should be considered. The advanced beginner "can demonstrate marginally acceptable performance" and has "coped with enough real situations to note (or have them pointed out by a mentor) the recurrent meaningful situational components, called aspects" (Benner, 1982, p. 403). Since advanced beginners must still remember rules and are unable to take in much of a new or strange situation, they require assistance in deciding what is the most important thing to do. The competent performer has a plan for action and is able to determine which aspects of the situation are most important and which ones can be ignored. Although the competent learner lacks speed and flexibility, deliberate planning assists in achieving efficiency and organization (Benner, 1984). At the fourth level, that of proficient, the performer views the current situation through a perspective of past situations and is able to determine when the expected normal events do not occur. Situations are seen holistically, as maxims which "reflect nuances of the situations" which are then used as guides in place of rules or principles (Benner, 1984, p. 34). At the fifth level, the expert does not need to rely on a rule, guideline or maxim, but has "an intuitive grasp" and a "deep understanding of the situation" (Benner, 1982, p. 405). Dreyfus and Dreyfus (1980) (quoted in Benner, 1984) have described the expert's performance this way:

> The performer is no longer aware of features and rules, and his/her performance becomes fluid and flexible and highly proficient. The chess player develops a feel for the game; the language learner becomes fluent; the pilot stops feeling that he/she is flying the plane and simply feels that he/she is flying (p. 34).

While the major use of the Dreyfus Model in nursing has been by Benner (1984) in studying the performance of skilled nursing practice, in this study the Model was used as it was originally developed, as a framework for the evaluation of the acquisition of a psychomotor skill.

Phases of Psychomotor Skill Learning

There seem to be three identifiable stages that learners experience in acquiring psychomotor skills (Adler, 1981; Fitts & Posner, 1969). Fitts and Posner (1969) described the three phases associated with the learning of complex skills in terms of cognitive, associative, and autonomous (p. 11). Since the phases overlap, moving from one phase to the next is a continuous process. The cognitive phase is relatively short in duration, and the focus is on thinking about the nature of the skill. Observing a model, reviewing instructions, and describing the skill to oneself are typical activities during this phase (Klausmeir & Ripple, 1971, p. 482). The instructor's role, according to Fitts and Posner (1969), is to help the learner to be aware of and attend to important perceptual cues and response characteristics, and to give knowledge of results (reinforcement) (p. 11-15). During the cognitive phase the learner is actually developing an executive plan of the skill to be learned. In the associative phase refinement of the motor movements takes place and there is less emphasis on cognitive activities. The student first learns to join together the basic units of the chain; later he is able to organize the chains into an overall pattern (DeCecco, 1968, p. 282). Speed and coordination improve, errors are gradually eliminated, and the skill becomes relatively stable. This stage may last for a few days to several months (DeCecco, 1968). In the last or autonomous phase there is an emphasis on speed and accuracy. As well, there is increased resistance to stress and to the effects of interference from outside activities (DeCecco, 1968).

Using Fitts and Posner's work, Robb (1972) developed three phases of motor learning. She specified them to be the plan formation, the practice session, and the execution.

Adler (1981) basically has agreed with the idea of three phases but has attempted to discuss the levels in more practical or applied terms. During the concept stage, the learner develops an overall picture of what is to be done, including the particular elements or movements involved. This initial concept formation seems to rely on visual stimuli (Fleishman & Rich, 1963), which may take the form of demonstrations and films. As part of the concept formation stage the learner must accomplish the task and know what it feels like to do the skill. This stage is completed when the learner is able to perform the whole skill, with attention focused on a part of the task (Adler, 1981, p. 76). In the adaptation phase, "...performance is adjusted to bring it closer to some criterion of form or accuracy" (Adler, 1981, p. 77). The goal of this phase is to improve proficiency and efficiency. At this point visual cues still are useful, but verbal encouragement is more effective. The learner is unable to perform to the criteria unless conscious attention is paid to some aspects of the required movements. The automation stage implies that the learner can now perform the skill without conscious attention to the movements involved. The purpose of practice at this time is to enhance memory and to lead to overlearning. It may be necessary for the teacher to devise ways to make the practice sessions as interesting as possible in order to encourage the learners to continue to practice.

Stallings (1976), Winfield (1979), and Turpin (1982) prefer the use of an information processing model that will allow for the classification, description and understanding of complex skills. For example, the four stages of Winfield's model are: input of information from the senses, brain planning and decision-making, output of actions undertaken by the limbs, and feedback from the output to the input (1979, p. 22).

Simpson (1965) has developed a taxonomy of the psychomotor domain that consists of seven hierarchial classification levels: perception (sensory stimulation, cue selection, and translation), set (mental, physical, and emotion), guided response (imitation and trial learning), mechanism (mechanics and habituation of movement), complex overt response (higher levels of performance), adaptation (refinement of basic motor processes), and origination (creation of new motor patterns).

Gentile (1972) has proposed that the learning of motor skills is a two stage process. During the first stage, the development of a movement pattern occurs, leading to goal attainment in the original performance environment. In the second stage, the learner repeats the performance of the task many times until he is consistently able to achieve the goal.

Classification of Psychomotor Skills

Attempts have been made to classify psychomotor skills into general categories by identifying the elements that are similar across skills. Magill (1980) has cited four classification systems based on precision of movement, distinctiveness of beginning and end points, stability of the environment, and feedback control (p. 17).

Two categories, gross motor skills and fine motor skills, have been developed based on precision of movement. Gross motor skills involve the use of the large muscle groups for movement. In contrast, fine motor skills involve the ability to control the small muscle groups, and require a high degree of precision of movement.

The distinctiveness of the beginning and end points has led to describing motor skills as discrete or continuous (Magill, 1980). Discrete suggests that there are definite beginning and end points. Continuous motor skills do not have definite beginning and end points; rather it is the performer and not the skill itself that determines the beginning and the end.

Skills can be classified according to the stability of the environment within which the skill is performed. Skills are described as closed if the environment remains stable throughout the act (Spaeth-Arnold, 1981). Once the individual has perceived the spatial characteristics of the environment, no further monitoring is required. Another feature of closed skills is that they are self-paced; the learner is free to set his own speed, rhythm, and sequence. Open skills are those in which the environment is changing, and constant monitoring is required. The spatial characteristics and the timing of the movements are now dictated by something moving in the environment (Spaeth-Arnold, 1981). In other words, "the performer must act upon the stimulus according to the action of the stimulus" (Magill, 1980, p. 19).

The fourth classification system is based on when feedback information can be used to adjust the action (Magill, 1980, p. 20). If it can be used during the movement, it is termed closed-loop. In skills in which there is no time to make adjustments, the feedback must be remembered until the next occasion. These skills are under open-loop control.

A fifth classification system is one based on the complexity of the skill. Fitts (1962) developed a two-dimensional taxonomy of motor tasks in which he indicated that a simple skill involves the movement of only one thing at a time; either the environment or the body. If both are moving, then the skill is classified as complex. Billing (1980) has identified a number of items that contribute to the complexity of each of four subcomponents of motor performance (p. 20). Perception of the environment is influenced by the number, duration, and intensity of stimuli, as well as the presence of conflicting stimuli. The decision about what to do depends on the number of alternatives, the speed and the sequence of the decisions, and the number of items needed from memory. The motor act itself is affected by the number of muscle actions, the amount of coordination needed, the speed-power required, and the precision involved. Feedback is made more complex depending on the quality, quantity, intensity, timing, the number of senses involved, and the presence of conflicting information. By examining the items present in relation to the four subcomponents it is possible to determine the relative complexity of motor acts. This information assists the teacher in adjusting the complexity of a motor skill to a level more appropriate to the learner (Billing, 1980).

Gentile, Higgins, Miller, and Rosen (1975) developed a composite taxonomy of motor skills (cited in Spaeth-Arnold, 1981). Motor skills are classified according to two dimensions of performance, depending on the type of movement, and the type of environmental context. Gentile (1972) restricted categories of movement response to instrumental ones in which the learner tries to find the correct movement pattern in order to attain the performance goal. Instrumental movements include two types: orienting and adaptive (Spaeth-Arnold, 1981). Orienting movements are used to assist the learner in focusing or adjusting the sensory apparatus to improve the reception of information from the environment (Gentile, 1972). Gentile does not however consider orienting movements as part of the taxonomy. Adaptive movements are used to maintain or change the position of the body in space, or an object in space, or both concurrently. The second dimension of the taxonomy (Gentile, et al., 1975) involves the analysis of the environment according to whether it is stable (closed skill) or moving and changing (open skill) (cited in Spaeth-Arnold, 1981). Therefore, correct classification of a skill requires assessment of three aspects of performance: stable position (body transport), secondary manipulation of limbs or objects, and environmental constraints (stable or moving) (Spaeth-Arnold, 1981, p. 22).

Classification of Intramuscular Injections. The skill of learning to prepare and give IM injections has many facets. It can be described in terms of involving fine motor coordination, particularly of the fingers and hands.

Classification of the skill as discrete or continuous is somewhat difficult. The skill is discrete in that the actual giving of the injection has a beginning and an end point. However, it is also continuous in that the performer has control over the beginning and end point; the nurse controls when to start the downstroke, and when to remove the needle.

Classification of the skill in relation to when feedback can be used is also unclear. Once the learner has begun the downstroke, there is still an opportunity for some immediate feedback that can be acted upon. For instance, if the needle did not go in far enough, the learner can be instructed to gently push it in to the appropriate distance. The learner can be reminded of the need to aspirate, and to inject the medication slowly. This type of feedback given during the performance would indicate that the skill is closed-loop in nature. However, some feedback is given after the injection, and cannot be used until the next injection. For instance, if not enough force was used, the student must wait until the next injection to make use of that feedback. This type of feedback suggests that the skill is open-looped.

Skills can also be classified according to the stability of the environment. Most of the time in nursing, injections would be classified as open, meaning that the action is self-paced, and that the environment may change and thus requires continuous monitoring. The learner positions the patient, locates the appropriate site for the injection, and then hopes that the patient will stay still while the injection is administered. Along with concentrating on the actual site and the injection, the skilled nurse also attends to the patient's emotional responses, and tries to assist the individual to cope with the injection experience.

Using the classification of complexity (Fitts, 1962), IM injections usually involve only one moving object, the nurse's hand holding the syringe and needle. If however, the patient also moves during the procedure, the skill would be considered complex. Adult patients tend to lie still for the procedure, thus making it an easier situation for the learner to begin to master the skill. Giving injections to children is more complex, due to the unpredictability of children, and the likelihood that they may move at the wrong moment.

Although it is difficult to completely classify intramuscular injections according to the previously mentioned categories, the exercise is useful in that it leads to close examination and a better understanding of the dimensions of this particular nursing skill.

Task Analysis

Siegler (1982) states that task analysis

> initially involves the breaking down of a complex problem into smaller, more precisely specifiable components. These components are then combined into one or more models of overall performance... Often, but not always, the models are intended as real-time depictions of a person's activities; first he does this, then he does that, and so on. Again often, but not always, the models are stated as flow diagrams or computer simulations; the purpose is to increase the precision of the description beyond that allowed by standard written language (p. 279).

Task Description. DeCecco (1968) and Davis, Alexander and Yelon (1974) agree that task analysis begins with a task description. A task description, or an instructional objective, is an explicit description of a terminal performance (DeCecco, 1974, p. 42). Mager (1962) has identified three critical components of a task description: the terminal performance, the conditions under which the behavior is to occur, and how good the performance must be (standards or criteria).

Types of Task Analysis. DeCecco (1968) has maintained that once a task has been described it is then necessary to analyze it in order to identify "classes of behavior which differ in respect to the conditions necessary for their learning" (p. 45). Winfield (1979) has suggested that five types of learning are relevant: signal, chain, multiple discrimination, concept, and principle (pp. 47-49). Signal learning involves making a specific response to a specific stimuli. Chain learning requires the learner to perform a set of responses in a fixed sequence. Multiple discrimination learning requires the learner to discriminate between stimuli that are similar in appearance or characteristics. Concept learning implies that the learner can make generalizations about events and objects, and learn new ideas relevant to the situation. The final type of learning, principle learning, involves the linking together of ideas or concepts to form a rule or principle. Many psychomotor skills contain a mixture of the different types of learning. It is important for the instructor to analyze the tasks and to decide which kinds of learning predominate. This is necessary since there are specific methods available for bringing about each type of learning (Winfield, 1979, p. 50).

Information processing analysis involves identifying the sequence of the components of the total performance. A wide variety of flow charts can be developed to illustrate simple and complex sequences. This type of analysis provides a clear description of the steps involved in a procedure, and allows for the inclusion of decision steps (Gagné & Briggs, 1974, pp. 102-104).

Gagné and Briggs (1974) have suggested that learning task analysis follows after the previous two types. It is "the means of identifying prerequisites of what is to be learned" (Gagné & Briggs, 1974, p. 105). Prerequisites are tasks that are to be learned before the learning of the target task is commenced. They may be considered essential for the learning of the target task, or they may support or assist in the learning of the target task (Gagné & Briggs, 1974, p. 106).

Once tasks have been broken down into their component parts, it leads to the question of how the skill can best be learned. Drowatzky (1975) has stated that the whole versus part issue is concerned with "the size of the unit that is presented to the learner" (p. 214). Generally, he has maintained that it is useful to start with larger units, and go to smaller ones if the students experience difficulties. Robb (1972) would agree for she is of the opinion that "many a task is complicated by separating it into its parts" (p. 64). Magill (1980) has contended that despite considerable research into the pros and cons of each method, the findings have led to more confusion than understanding. However, in 1963 Naylor and Briggs made a major contribution towards resolving the issue by proposing that two features of any task be considered: task organization and task complexity. For example, a highly complex task would consist of many components and would require considerable attention throughout (Magill, 1980). How the component parts of a task are interrelated is considered to be the task organization. If the parts are highly interrelated, then the task has a high degree of organization. Each of these two features can be considered as a continuum of low to high. Some general conclusions can be stated:

> If the skill is high in complexity but low in organization, the practice of parts would be recommended. But, if the skill is low in complexity and high in organization, practice of the whole or entire skill would be the better choice. (Magill, 1980, p. 280)

If complexity and organization are somewhere in the middle, probably a combination of whole and part practice would be useful. Drowatzky would agree that the part method is suitable for more complex skills as it has the advantage of overcoming boredom and fatigue that can occur when a whole sequence is repeated, and it provides for more rapid feedback and reinforcement (1975, p. 216). He has stressed that if part learning is used, time must be allotted to putting the skill together.

Learning Strategies

Cognitive processes are made up of two categories: performance components and strategies. According to Kirby (1984), the performance components are involved in encoding, transforming, and storing information. The strategies are needed for "controlling or planning the use of these processes..." (Kirby, 1984, p. 4). A strategy is mainly a way to approach a task, or to attain a goal (Kirby, 1984). Singer and Gerson (1979) have indicated that a strategy may be self-initiated, or it may be externally imposed. When human subjects are exposed to new situations, whether they learn or not, what they learn, and how much they learn is critically dependent upon the cognitive strategies they use in dealing with the situation. "Human beings may acquire a battery of different learning strategies or skills that they can apply as circumstances, motives, and materials require" (Bower & Hilgard, 1981, p. 424). Differences in learning abilities among people are based on the particular strategies they have acquired.

A model for a general learning strategy system has been developed by Dansereau, McDonald, Collins, Garland, Holley, Diekhoff, and Evans (1979). The model contains primary strategies which are used directly on the material to be learned, and support strategies which help the learner to maintain an appropriate climate for learning. The primary strategies include comprehension-retention activities, and retrieval-utilization methods. These two main strategies are further divided into the substrategies of understanding, recalling, digesting or detailing, expanding, and reviewing (Dansereau et al., 1979, p. 6). Three categories of support strategies have been identified: goal setting and scheduling, concentration management, and monitoring and diagnosing (Dansereau et al., 1979, p. 5).

Weinstein, Underwood, Wicker, and Cubbery (1979) have identified five different categories of strategies used by graduate students, community college students, and army recruits, of varying academic qualifications. These categories include: rote strategies (emphasizing repetitions), physical strategies (making use of the physical properties of the material), imaginal elaboration (formation of a mental picture), verbal elaboration (actively working with the material, verbalizing steps), and grouping (arranging the material into subsets) (p. 50).

Kirby (1984) has identified several strategies that have been shown to affect performance. These include "verbalization (naming of to-be-remembered items), rehearsal, semantic categorization, elaboration (both imaginal and verbal), and semantic integrational" (p. 55). C. Smith (1983) has proposed that performance can be improved by teaching students strategies such as visual imagery, verbal mediation, search training, and modeling. Mental practice or rehearsal of a skill can be carried out prior to, during, or after the performance of the skill, and forces the learner "to translate the problems inherent in performing a complex movement into verbal descriptions and word cues" (Cratty, 1973, p. 6).

When beginning to learn a skill it is crucial that the student have a clear understanding of how the skill should be performed. This appears to be essential for the planning phase as it plays a part in determining the initial actions of the student (Hanson, 1977). Once students understand how a skill is to be performed, they should be able to differentiate between acceptable and unacceptable performances (Rhode et al., 1980). Findings from a study by Fleishman and Rich (1963), and the work of Bandura (1971) indicate that early in skill acquisition it is the ability to use knowledge in a visual form that is important. Adams (1971), on the other hand, has reported that verbal skills are critical; the knowledge must be put into words that can be repeated. Later in skill acquisition it appears that the student is more likely to use kinesthetic knowledge from the perception of position and movement of body parts (Fleishman & Rich, 1963).

Teaching Strategies

Lecture. Cooper (1982b) has defined a lecture as "a carefully prepared oral and formal presentation by a qualified speaker" (p. 39). Even though the traditional lecture method has been used in the instruction of large groups for many years, it continues to be a valuable teaching technique. For presenting certain content, such as factual material, and for certain learners, it may be the method of choice. McLeish (1976) has pointed out that the lecture method can lead to the attainment of instructional objectives by inspiring the audience through the lecturer's enthusiasm, stimulating student interest through relating the field of study to human purposes, and relating theory and research to practical problems. The success of the lecture method is largely due to the lecturer functioning as a role-model in establishing positive attitudes towards the learning content. In the lecture it is possible to gain the student's attention, clearly present the instructional objectives, and to summarize the content in such a way that students are assisted in retention and transference of the material (Day & Payne, 1985). In order that the content does not go "from the notebook of the teacher to the notebook of the student, without going through the minds of either", it is necessary to provide opportunities for questions and discussion within the lecture presentation (Cooper, 1982b).

The theory and principles of asepsis, injections, and medications can readily be presented using a lecture format. Specific content related to the preparation and administration of IM injections, such as selection of appropriate needle gauge and length, selection of the correct size of syringe, preparation of the patient, the importance of landmarking to locate the exact site for the injection, the location of underlying nerves and blood vessels, and precautions to be taken while disposing of used equipment, can be presented to students prior to the first practice session. The lecture allows for the reinforcement and highlighting of reference material assigned to the students.

Demonstrations. Cooper (1982a) has described a demonstration as "a presentation that shows how to perform an act or procedure, or how to use a piece of equipment..." (p. 44). Cratty (1967) has noted that demonstrations are particularly effective in psychomotor learning. However, demonstrations should be short, cover only one or two aspects, and should leave the learner with the feeling that it is possible to learn the skill being demonstrated (M. Smith, 1976). It is helpful if the demonstrator gives cues to focus the attention of the learner on relevant aspects of the performance. Landers (1978) has pointed out that retention is enhanced by including verbal rehearsal cues and labelling parts of the task during the actual demonstration.

In contrast to those who believe in the learning-by-doing view, social learning theorists such as Bandura hold that "a large amount of human learning is done vicariously, through observing another person making the skilled responses... and then trying to imitate the response of the model" (Bower & Hilgard, 1981, p. 462). At a later time, the observer can perform novel responses without having done them before. Bandura (1965) has stated that the trial and error way of learning inherent in operant conditioning is an inefficient way to teach psychomotor skills, and can in fact be highly dangerous. Operant conditioning plays a role in "strengthening and maintaining responses that already exist in the behavioral repertoire of an organism" (Bandura, 1965, p. 313). It is not an efficient way to develop new skills.

Bandura and his associates have identified three factors that appear to influence modeling: the characteristics of the model, the attributes of the observers, and the reward consequences associated with the behavior (Schultz, 1981). People tend to be influenced by others who are like themselves. "The more remote the model is from reality, the weaker his modeling influence" (Bandura, 1965, p. 321). More attention is paid to models of the same sex and similar age. Peers who are viewed performing a skill that the observer is to attempt to master are extremely influential models. In this case the observer may have the motivating and comforting thought that "if she can learn to do it, then so can I". "Models who are rewarding, prestigeful, or competent, who possess high status, and who have control over rewarding resources are more readily imitated than those who lack these qualities" (Bandura & Walters, 1963, p. 107). If a nursing instructor was the model for skill demonstrations, students might be encouraged about the possibility of mastering the skills. Since the potential for rewarding behavior (examinations and marks) is present, the instructor might in fact be a powerful role model. The characteristics of the observers play a role in determining the effects of modeling. Observers who believe that they are similar to the model in some way will tend to match the model's behavior (Bandura & Walters, 1963, p. 84). Imitation tends to be facilitated when the model's behavior is rewarded. Alssid and Hutchison (1977) found evidence to support the hypothesis that a pure video model (exhibiting only desired outcomes) resulted in greater learning than a corrective video model (exhibiting both desired and undesired behaviors). Negative modeling examples may actually interfere with learning during the introductory phase.

Four interrelated processes or mechanisms that govern observational learning have been identified by Bandura (1977): attentional, retention, motor reproduction, and motivational. In order for modeling to occur, the observer must attend to and carefully watch the model. The retention process is important because if the observers are unable to remember the behavior they observed, they certainly will be unable to imitate it at a later time. Retention is facilitated by forming images of what was seen and by verbally describing the behavior or rehearsing the sequences. These two symbolic representations allow an observer to store observed events and to retrieve them later for rehearsal. The motor reproduction process refers to actually performing the skill correctly. The fourth mechanism involves incentive and motivational processes. If individuals are not motivated they will not attend to the role model, and there will be little retention of the material. If the learners are aware that they will be expected to perform the skill with patients in a few days (such as happens with injections), motivation tends to be high. Reinforcement can facilitate the learning process but it is not necessary for learning to occur. Self-reinforcement occurs when the learners reward or punish themselves for their performance.

The findings of Bandura, Ross, and Ross (1963), Brown and Calder (1986) and Landers (1978) suggest that films and videotapes are as effective as live models, and ensure the correctness and convenience of demonstrations. Films and tapes make it possible for all students to view exactly the same performance. A study by Van Mondfrans, Sorenson, and Reed (1972) concluded that taped demonstrations were more effective than live ones in promoting student learning.

In the case of IM injections, a videotaped demonstration could include the following: checking of doctor's orders and time of previous drug administration, selection and assembly of appropriate equipment, drawing up the medication into the needle and syringe, preparing the patient, landmarking to locate the correct size, aspirating (drawing back to determine if the needle is in a blood vessel), giving the medication, making the patient comfortable, disposing of equipment, and recording the administration of the medication. Each student has an opportunity to see all of the steps of the procedure and to observe how an expert role model prepares the patient for the injection (including locating the correct site), and provides for patient comfort following the injection. Students are interested in and can be reassured by the patient's reaction to the injection.

Laboratory Practice. At various times nursing educators have alternated between having students learn skills in a laboratory setting, or learn directly with patients in a clinical setting. Due to the expensiveness of having large numbers of faculty present in a clinical setting, the increasing difficulty in locating appropriate clinical experience (more learners competing for spaces), the complexity of the clinical setting, and the concern that patients have a right to be cared for by well prepared practitioners, the trend has been to return to the laboratory for basic nursing skill learning (Hallal & Welsh, 1984). Infante (1981) has defined the laboratory as a place "...that is equipped with simulated materials for the nursing student to practice aspects of care in an artificial instead of real situation" (p. 17). No patients are present in this setting, but students often practice skills on each other. The atmosphere of the laboratory allows students the freedom to experiment, and to experience success and failure within a supportive group of classmates and faculty members.

Once the students are provided with the theoretical content and see a demonstration they have begun to form a motor plan or image of how the skill is to be performed. The formation of the plan is important in determining the initial movements of the students (Rhode et al., 1980). They need to experience what the particular movements look like and how they feel. As they attempt the skill, two types of feedback can be provided: the performance itself is compared with the motor plan, and the results of the performance are used to determine how the learner will try the skill the next time (Pease, 1977). The student then needs further opportunities to practice the skill. Bandura (1965) has emphasized the need for practice.

> In the acquisition of psychomotor skills, which are governed largely by proprioceptive stimuli that are neither observable nor easily described verbally, exposure to modeling behavior is insufficient for learning; consequently, varying amounts of overt practice are generally necessary. (p. 331)

When teaching intramuscular injections in the laboratory students usually have the opportunity to practice drawing up medication into the syringe from a variety of containers such as vials, ampules, and multi-dose vials. They then can give the injection into different inanimate objects such as oranges, pillows, or pieces of flank steak. The students are provided with opportunities to experience the actual movements involved in inserting a needle into an object. In the case of the meat, the students also receive fairly accurate feedback in relation to how much force is required to put the needle into the muscle tissue of a real person. After all students have experimented with the simulations they are then ready to try the skill on each other. Due to the dangers involved in the procedure, very close supervision is required while each student prepares and administers the injection to a classmate.

Personological Variables Affecting Skill Acquisition

Age. The child from about age six possesses all the necessary patterns and elements of coordination but it is not until age 25 to 30 that normal coordination reaches its peak (Kottke, Halpern, Easton, Ozel, & Burrill, 1978). It is possible that nursing students directly out of high school may be at a disadvantage when trying to learn complex psychomotor skills before they have reached their peak level of coordination. Older students will have had longer to practice a wide variety of patterns and may have been exposed to numerous life experiences. On the other hand, Eaton and Davis (1982) have pointed out that the older student may be more self-conscious about trying a new skill; "they worry about looking foolish and making errors" (p. 62).

Knowledge. In order to perform an injection, students must first understand the necessary theory related to the principles of asepsis, the principles of drug administration, as well as content related specifically to the preparation and the administration of an intramuscular injection (position of patient and location of various sites).

Academic Achievement. Singer (1972) has maintained that there is little convincing research evidence to demonstrate any relationship between academic achievement and the ability to learn and perform psychomotor skills. Ismail and Gruber (1967) studied the reverse side of the coin: does motor aptitude influence or predict intellectual performance? Their findings indicated that high achievers displayed more coordination and balance then medium or low achievers.

Manipulative Dexterity. Dexterity refers to smooth and rapid, or skillful movement, usually of the arm, hand, or fingers. Manipulative dexterity is a generic term, which includes both finger and manual dexterity (Speakman, 1976). According to Speakman (1976), "finger dexterity is the type of motor performance required when the thumb, index finger and sometimes, the middle finger are used to manipulate small objects quickly and skillfully" (p. 216). Manual dexterity refers to the "type of motor performance required when the first four, or all, digits are used to manipulate large objects quickly and skillfully" (Speakman, 1976, p. 216). One component of dexterity is coordination, which can be described as the harmonious cooperation of numbers or groups of muscles in a complex series of actions. The definition of motor coordination on the General Assessment Test Battery (GATB) (1970) is more specific and refers to the "ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed" (p. 17). Several examples can be found in the physiotherapy literature describing methods in the training of coordination (Kottke, 1980; and Kottke, Halpern, Easton, Ozel & Burrill, 1978). Eaton and Davis (1982) have suggested that activities such as knitting and needle work have been used to help develop fine motor control and finger flexibility (p. 62).

Although nursing requires its practitioners to use fine and gross motor control in a variety of psychomotor skills, little attention has been directed to the importance of manipulative dexterity. No nursing studies have attempted to identify the role that manipulative dexterity plays in how students learn and perform psychomotor skills.

Anxiety. Anxiety is a complex mental state with apprehension or dread as its most prominent feature. Schultz has defined it as "an objectless fear" (1981, p. 31). Lesse (1970), has divided anxiety behavior into four components: motor, affective, autonomic, and verbal (cited in Blainey, 1980). Tremors of the hands, intermittent increases in muscle tone, and the inability to stay still for long periods are behavioral examples in the motor domain. In the affective domain, facial appearance of apprehension, change in the pitch and volume of the voice, and a tremulous quality to the voice may be apparent. Although Lesse was unable to identify manifestations within the autonomic domain, Blainey (1980), has identified that "dilated pupils, pulsating carotid arteries, and red blotches in the skin of the face and neck are observable autonomic manifestations of anxiety" (p. 34). In the verbal domain, speech becomes more rapid and blocking occurs occasionally. Additional common manifestations of anxiety include: difficulty in keeping thoughts together, sweating of the hands, and general distractibility (Gaudry & Spielberger, 1971, p. 7). All of these factors could have an effect on psychomotor skill learning. Sieber and Kameya (1967) found that highly anxious students in stressful situations not only tended to make more mistakes, but failed to recognize mistakes they had made, and that this was caused in part, by anxiety produced deficits in memory (cited in Gaudry & Spielberger, 1971, p. 21). At the other end of the scale, little or no anxiety represents understimulation, and also leads to poor performance (Captain, 1984). A certain amount of anxiety may actually be useful, since it increases ability to focus on a specific task and to ignore irrelevant factors in the environment (Captain, 1984).

Two types of anxiety are commonly discussed in the literature: trait and state. Trait anxiety scales measure individual differences in anxiety proneness, and are quite stable over time. In situations that are perceived by subjects as threatening, state anxiety responses will be evoked. State anxiety scales usually measure feelings of tension, nervousness, worry, and apprehension, and are sensitive to situational changes (Spielberger, 1971).

In terms of injections, Field (1981) found that students and graduate nurses alike tend to experience the giving of an injection "into" another person as an anxiety-producing situation. Mogan and Thorne (1985) identified an emotional component present in intrusive nursing skills such as giving injections. Blainey (1980) specifically identified the giving of intramuscular injections as a frequent source of anxiety for nursing students.

The intervention used by Blainey (1980) in relation to anxiety included validation of the existence of the anxiety, identification of the source of the apprehension, and the development of a plan for overcoming the anxiety. Blainey has pointed out that validation of the presence of anxiety may be difficult since students attempt to mask their anxiety by engaging in other behaviors such as anger, crying, withdrawal or boredom. The instructor must be sensitive to the possibility that anxiety may be the real problem that is interfering with the learning process.

Scandrett (1985) has described a process which includes evaluating the cause of stress, teaching the client how to relax in response to the stress, and changing the client's perception of the situation (p. 50). The intervention used to assist an individual with changing the perception of the situation is termed cognitive reappraisal, cognitive restructuring or cognitive therapy. This approach is based on cognitive theory which purports that "maladaptive feelings are caused by maladaptive thoughts" (Scandrett, p. 50). Specifically in relation to anxiety, three assumptions are made: pessimistic thoughts that can cause anxiety are often unrealistic, illogical and distorted; moods and feelings are influenced by current thoughts; and some clients have cognitive schemata that predispose them to anxiety (Childress & Burns, 1981). An individual may engage in the use of self-defeated cognitive distortions such as "all or nothing thinking", overgeneralizations, dwelling on a single negative detail, ignoring positive experiences, jumping to conclusions, catastrophizing or minimizing, using "should" statements, labelling oneself negatively, and personalizing (Meichenbaum, 1977).

Cognitive reappraisal is a "structured short-term treatment for depression and anxiety, based on helping the client to identify and change distorted thought patterns that trigger and perpetuate one's distress" (Childress & Burns, 1981, p. 1024). Clients are assisted to identify cognitive distortions and to get more in touch with their bodily reactions (Scandrett, 1985). A benign interpretation of the event can be provided. Later, behavioral techniques are used to "reinforce changes in their beliefs about the feared stimuli and to decrease anxiety response habits" (Scandrett, 1985, p. 51).

Scandrett (1985) has outlined a five step process of reappraisal. The first step is stress identification. Then the specific stressors are examined in relation to the incidence of stressors, frequency, and meaning of stressors to the individual. The third step involves having the individual assign priorities to the stressors (from most upsetting to least upsetting). This way the individual can focus on the most important ones. Attention is then directed to coping skills. The individual's perception of ability to control a stressor is important. As individuals learn more facilitative coping skills they are able to move from "passive victims" to "active participants" in handling life (Scandrett, p. 53). The fifth step involves specific techniques such as extinction procedures, persuasion, vicarious experiences, imagery, and problem solving, that help the individual to let go of the stressors.

Self-Esteem. Battle (1981) has defined self-esteem as follows:

> Self-esteem ... refers to [the] perception the individual possesses of his own worth. An individual's perception of self develops gradually and becomes more differentiated as he matures and interacts with significant others. Perception of self-worth, once established, tends to be fairly stable and resistant to change. (p. 14)

Those individuals with high self-esteem tend to become more competent and productive in all facets of their life. When there is a lack of self-esteem, the individual feels "inferior, helpless, and discouraged and lacks sufficient confidence to cope with problems" (Schultz, 1981, p. 247-248).

Self-esteem, or the belief in oneself, is believed to be closely connected to anxiety (Ausubel, 1968; Gaudry & Spielberger, 1971). When anxious individuals are faced with an important and novel skill to master, they experience feelings of inadequacy. These types of situations are viewed by the individual as an exaggerated threat to self-esteem, and they over respond with fear (Ausubel, 1968, p. 406). Rosenberg (1953) found a strong negative relationship between self-esteem and anxiety, pointing out that anxious students hold themselves in low self-esteem. Sarason, Davidson, Lighthall, Waite and Ruebush (1960) (cited in Gaudry & Spielberger, 1971) noted that anxious children develop self-derogatory attitudes and will tend to blame themselves for their failures.

Self-Efficacy. Bandura (1982) has developed a model that highlights the importance of expectations about how effective one's behavior will be (efficacy expectations), and whether a given behavior will lead to certain outcomes (outcome expectations). The efficacy expectations could be the conviction that one can successfully execute the behavior required to produce the outcome. Students are willing to try a new skill if they judge themselves capable of handling the situation. When self-efficacy is high, the student will persist longer at the skill, and will expend more effort (Bandura & Schunk, 1981). If the student is successful, self-efficacy is increased. If the student stops prematurely, decreased self-efficacy can occur.

There are four major sources of knowledge about efficacy of a given behavior: past accomplishments, observing others' successes or failures with the behavior (vicarious experience), verbal persuasion by self or others, and changes in one's emotional arousal in the situation (Bandura, 1977). Actually performing the behavior provides the most reliable source of evidence on which to base a change in one's efficacy expectations (Bower & Hilgard, 1982). For example, the best basis for predicting that an individual will be able to give an IM injection, is the knowledge that the individual has just given one.

CHAPTER III

Methodology

Introduction

The purpose of the study was to describe how nursing students learn and perform a particular psychomotor skill, that of intramuscular injections. The types of research methods, the subject sample, and the data collection procedures are described.

Research Methodologies

For the purpose of this study, triangulation was used. Denzin (1978) has defined triangulation as "the combination of methodologies in the study of the same phenomenon" p. 291). Both qualitative and quantitative methods of data collection and analysis were used to "capture a more complete, holistic, and conceptual protrayal of the unit(s) under study" (Jick, 1979, p. 603). Jick (1979) has proposed that triangulation accents the assets of each method, and "neutralizes" the liabilities (p. 604).

Several researchers, including Swanson and Chenitz (1982), Simms (1981), and Field (1983) has suggested that qualitative methods assist in answering the question, "how can we know that which is not known?". Diers (1979) has stated that exploratory or descriptive studies answer the question "what is this?" and produce theory that isolates categories and attaches names (p. 36-38). In light of the lack of nursing literature on the topic of skill acquisition, qualitative methods were considered appropriate to gain more awareness of what the learners experience as they learn this particular skill. A classification of the phases and strategies experienced by the nursing students learning to prepare and administer IM injections was developed.

From a quantitative perspective, the question to be answered in this study was "what is happening here?" (Diers, 1979, p. 38). Variables pertaining to the nursing student subjects (knowledge of asepsis and intramuscular injections, manipulative dexterity, academic achievement, age, anxiety, self-esteem, and self-efficacy) were examined to determine if the factors were related to one another, and if they were related to the performance of the skill of preparing and administering of an IM injection.

Sample Population

The sample population consisted of basic baccalaureate nursing students, enrolled in the course Nursing 320, in the Faculty of Nursing, University of Alberta, during the term January to April, 1985. The class that term included only female students, ranging in age from 18 to 32. Nursing 320 occurs in the second year of the four year program and is designed to provide learning opportunities in both theory and practice in asepsis (sterile techniques), medication, injections, and other nursing technologies. In the prior fall term, 1984, the students studied about and cared for maternity patients and their newborn infants. The sample size consisted of 48 students in Nursing 320 who voluntarily gave consent to participate in the study. Since this study involved students within the Faculty of Nursing, at the University of Alberta, ethical clearance had to be obtained from the Ad Hoc Ethics Review Committee of the Faculty prior to the beginning of the study. The purpose of the study, the procedures required, and the time involved were explained by the investigator to all of the students in Nursing 320. Students were assured that their participation or non-participation in the study would in no way affect their grade in the course, and that they were free to withdraw from the study at any time without penalty. Questions related to the study were encouraged. The students were assured that all audiotaped data and field notes would be kept in locked cabinets throughout the study, that the taped data would be erased at the conclusion of the study, and that it would not be possible to identify any of the subjects in reports of the findings.

Those volunteering for the study were required to sign a consent form (Appendix 1), and the signing was witnessed by a faculty member involved in the course. Forty-eight of the possible 55 students agreed to participate in the study. Two students failed the course and subsequently were unable to complete the final injection and interview during the spring session course that followed.

Data Collection

Data were collected using a variety of methods.

Participant Observation. Participant observation methods can be classified according to the degree of involvement of the observer (Field, & Morse, 1985). The goal of participant observation is "to record what actually happens" (Bruyn, 1970, p. 319).

For the lecture presentation, the investigator was a "complete observer", "...having no direct social interaction in the setting" (Field & Morse, 1985, p. 77). However, in the learning laboratory, the investigator played the role of "participant-as-observer" by working as an instructor with groups of students as they practiced intramuscular injections, while at the same time making observations of what was occurring in the situation (Field & Morse, p. 76). "In this method the participants in the setting are aware of the researcher's purpose and dual roles" (Field & Morse, p. 76). Initially, the investigator had intended to be a "complete observer" in the learning laboratory, but the need to ensure that all students completed the learning experiences in a limited time period necessitated a more active role. While being actively involved may have decreased general observations of all groups of students, it did provide for a more in-depth understanding of the experience of several groups of students.

The videotaped demonstration that was shown during the laboratory session featured the classroom lecturer (a Nursing 320 faculty member) as the role model preparing and administering IM injections into two different sites, and the investigator as the patient.

Semi-Structured Interviews. Semi-structured interviews were conducted at three intervals and were audiotaped. Interviews provide a wealth of data since it is possible to obtain information that would have been missed by more impersonal methods. In addition, there is an opportunity to clarify responses and correct any misunderstandings of the questions (Murphy, 1980). Johnson and Smith (1975, p. 207) have listed several benefits of the structured interview: the questions are based on the objectives of the study, and the interviews can be standardized, and the results compared. It is important to note that the effectiveness of the interview is dependent upon the effectiveness of the interviewer and the honesty of the subjects. The interviewer must be understanding and non-judgemental of statements made by the respondents. Interviewer-expectation effects may result from using probes to lead the respondents, failing to probe when answers are unclear, errors in recording, and communicating interviewer expectations (Bradburn & Sudman, 1980, p. 26). In addition, the respondents may feel anxious when asked threatening questions. Bradburn and Sudman (1980) reported that respondents who feel anxious about a topic will be less likely to respond accurately. They may feel a need to present a particular image to the interviewer. If respondents are assured of confidentiality, this may have a positive effect on their willingness to answer the questions.

The purpose of the first interview (Appendix 2), at the beginning of the study, was to collect background information. The focus of the interview was on questions related to:

1) the performance of fine motor activities such as knitting, crocheting, needlework, sewing, model building, playing musical instruments, typing, cashiering, etc.
2) gross motor activities such as swimming, baseball, volleyball, racquet sports, farm work, etc.
3) self-description of themselves as unskillful -- skillful.
4) identification of phases in previous skill learning.
5) strategies used to learn psychomotor skills in the past.
6) self-description of usual anxiety levels when faced with a new learning task, and in relation to IM injections.
7) self-description of level of self-esteem generally, and in relation to IM injections.

8) self-description of self-efficacy generally, and specifically in terms of IM injections, including statements of efficacy expectations and outcome expectations.

The second interview (Appendix 3) occurred after each subject had given her third IM injection to a patient in the clinical setting. The focus was on the evaluation of the teaching strategies, the identification of the phases involved in learning to prepare and give an IM injection, and the strategies used to facilitate the learning. This phenomenological approach aims to "describe the experience as it is lived" (Oiler, 1982, p. 178).

The third interview took place after a final IM injection was given during the 3-week spring session course that followed the second term course. The purpose of the interview was to summarize all aspects of psychomotor learning found to be relevant to each subject (Appendix 4). The subjects were asked to give a self-description of themselves in terms of:

1) how confident they felt about preparing and giving IM injections.
2) how skillful they perceived themselves to be in preparing and giving IM injections.
3) level of anxiety experienced during preparation and administration of IM injections.
4) level of self-esteem generally, and in relation to IM injections.

5) self-efficacy generally, and specifically in terms of IM injections.

The subjects were also asked to discuss any differences experienced with giving an IM injection to a child versus an adult.

For some of the questions posed during the interviews, and for the measurement of anxiety, self-esteem, and self-efficacy, the students were asked to complete self-report scales. Such self-report scales have been criticized on the grounds that the scale items may be ambiguous and unclear, the subjects may not know themselves well enough to answer accurately, or that subjects are not willing to disclose negative information about themselves (Spielberger, 1971). In at least the case of the State-Trait Anxiety Inventory, research has shown the following:

> Adolescent and adult subjects with at least dull normal intelligence are capable of describing how they feel at a particular moment in time and that most people are willing to reveal how they felt while performing on experimental tasks, provided they are asked specific questions about their feelings and the feelings were recently experienced. (Spielberger, 1971, p. 270).

Measurement of Anxiety. Psychological anxiety was measured by the use of the State - Trait Anxiety Inventory (STAI) developed by Spielberger, Gorsuch and Lushene (1970). The STAI measures state and trait anxiety through the use of two self-report scales. The reliability of the STAI is demonstrated by measures of internal consistency.

In female college undergraduates, the Alpha co-efficients (using the K-R 20) were .89 for both the state and trait anxiety scales (p. 10). In terms of validity, the trait scale correlates well (.75 - .80) with other trait anxiety tests (p. 10). With female college students, the state scale was sensitive to changing conditions, e.g., initial test score (37.24), score after an exam (43.69), score following relaxation (29.60), and score after viewing an upsetting movie (60.94) (p. 11).

In the present study the STAI was administered to the subjects prior to beginning instruction about IM injections (Appendices 5 & 6). Then, only those items measuring state anxiety, were administered to the subjects immediately following their first injection with a classmate, following their second and third IM injection with patients, and following their final IM injection (Appendix 7). Spielberger (1970) has indicated that for research purposes it is acceptable to ask subjects to focus on a particular time period, and to have them respond to the STAI-State items according to how they felt while performing a task that they had just completed. In this study, it was decided to have students complete the STAI-State questionnaires after the injections. The rationale for this decision involved the fact that students often have a limited time period in which to prepare and administer the injection. It was thought that having to complete the anxiety questionnaire before the injection might actually increase anxiety by focusing the students' attention on their anxiety, as well as by placing more pressure on the students by reducing the time available for the injection.

Along with the STAI state items, the subjects completed Form B (Appendix 8), indicating their level of anxiety experienced during each of the main steps of the IM injection procedure. A number of researchers have discouraged the use of the STAI-State questionnaire on the grounds that it is such as general inventory that it would not be sensitive enough to measure anxiety in motor activities (Carron, 1971; Martens & Smith, 1976). In this study, the question was raised as to whether or not the STAI-State was specific enough to measure anxiety related to IM injections. In response to this concern, Form B was developed by the investigator, to collect data on students' anxiety in relation to the seven main steps involved in preparing and administering an IM injection. Content validity of the form was established by having three nursing faculty members and 11 third-year baccalaureate nursing students review it to determine if the seven major steps were in fact the important ones to use in assessing anxiety related to IM injections. Form B was then pilot tested with 11 third-year baccalaureate students, on two occasions, with a one week interval between testings. The students were able to rate their level of anxiety, and found the questions to be clear.

Measurement of Knowledge. Measurement of knowledge of asepsis and IM injections was obtained by administering a 16 item multiple choice test developed by Boyd, McKiel, and Murphy (1983). The test was given one week after the lecture and demonstration session but prior to giving IM injections to patients, and again at the completion of the study (Appendix 9). Test-retest correlation obtained by Boyd, McKiel and Murphy was 0.719 (p<.01) (1983). Using the Spearman-Brown correction formula for test length, the corrected split half reliability co-efficient was 0.54. These measures provide evidence of the general utility of the test (Boyd, McKiel & Murphy, 1983, p. 66).

Measurement of Performance. The first injection with a patient was not evaluated in order that students would have an opportunity to freely practice and discuss this new procedure. The second and third injections, and the final IM injection were evaluated using the Intramuscular Injection Observation Sheet (IIOS) developed by Boyd, McKiel and Murphy (1983) (Appendix 10). Content validity of the tool was originally established by consulting the literature, testing in the laboratory and finally, by a panel of experts examining their own methods of giving IM injections and reaching agreement on the steps necessary for adequate performance (p. 51). Item reliability was established by calculating a percentage agreement among eight raters for each item (range from 82% to 95%, with a mean of 89.5%) (p. 51).

In this present study, content validity was established by nine raters (eight clinical instructors and the investigator) reaching agreement that the IIOS contained the appropriate steps for giving an IM injection. The nine raters were then trained in the use of the IIOS. This involved reviewing the checklist and discussing and agreeing on what would constitute as a "yes" or a "no" performance. The guide to using the IIOS developed by Boyd, McKiel, and Murphy (1983) was discussed and adapted for use in the study (Appendix 11). The raters then used the IIOS to rate three specially prepared videotapes in which nursing instructors not in the study deliberately made three, seven and twelve errors respectively. Some examples of errors were not washing hands prior to beginning the procedure, selection of inappropriate sized needles, contamination of equipment, and failure to identify patient before giving the medication. The percentage agreement among the raters on each of the 43 IIOS items on each videotape was calculated to be over 80%. The mean percentage agreement among the nine raters was 83.45% on Video #1, 88.11% on Video #2, and 88.11% on Video #3.

During the spring session course, after the final injection was given, each rater completed Form C (Appendix 12) and rated the subjects in their own clinical group in relation to:

1) the rater's confidence in each subject's ability to give an IM injection without supervision.
2) the rater's perception of how skillful each subject's performance appeared on the final injection.
3) the level of knowledge of IM's and asepsis.

Form C was developed by the investigator to collect data regarding the rater's evaluation of student knowledge and performance, in order that a comparison could be made with the student self-evaluations.

Measurement of Manipulative Dexterity. Manipulative dexterity was measured by using appropriate subtests of the General Aptitude Test Battery (GATB) (1970, p. 17). Five subtests used to measure motor coordination, finger dexterity, and manual dexterity were administered at the beginning and at the end of the study. Subjects were asked if within the 24 hours prior to the testing sessions, they had taken any medications that could cause drowsiness or difficulty operating machinery.

In validation studies of the GATB tests (1970) using general duty nurses, phi co-efficients of .41 for predictive validity, and .24 for concurrent validity have been obtained (p. 82). When aptitudes were correlated with grade point averages for nurses, finger dexterity was significant at the .01 level (p. 82).

Measurement of Self-Esteem. The Culture-Free Self-Esteem Inventory for Adults, a Canadian test developed by Battle (1981), was used to determine the perception an individual has of his own worth (self-esteem) (Appendix 13). The test has been standardized using college students, and is appropriate for use with senior high students and adults over a wide age range. The 40 item test consists of four types of items: general self-esteem, social self-esteem, personal self-esteem, and lie (items that indicate defensiveness). Test-retest reliability is 0.81 for all subjects, 0.79 for males, and 0.82 for females (Battle, 1981, p. 13). The test was administered both at the beginning and at the conclusion of the study.

Measurement of Self-Efficacy. Subjects were asked to estimate the amount of confidence they had in their ability to perform certain tasks related to the preparation and administration of IM injections. Measurements were made at the time of the first interview, and immediately before Injections #2, #3, and the Final Injection, using Form A (Appendix 14). Form A was developed by the investigator to assess the level of self-efficacy experienced by students in relation to the seven steps involved in preparing and administering IM injections. The use of the 10 point rating scale and the category "unable to do" were adapted from a scale used by Bandura (1984). Three faculty members and 11 third-year baccalaureate nursing students verified that the seven steps used in the Form were the most important components of preparing and giving an IM injection. Form A was pilot tested with 11 third-year baccalaureate students on two occasions, with a one week interval between testings. The students had no difficulty in rating their ability to perform the various components of the injection procedure, and they found the questions to be clear.

Descriptive Measurements. Upon completion of the academic year in May, the subjects' files were examined to obtain the following data: age, score obtained on the practical physical examination in the first year of the program, grade obtained in the nursing course completed in Nursing 320, and grade point average for the second year of the baccalaureate nursing program.

Analysis. Descriptive statistics, correlations, and analysis of variance were employed. Significant differences noted on t-tests were then subjected to a posteriori Scheffé procedure and the Newman-Kuels procedure.

The qualitative data were transcribed from the audiotapes and the interview notes. The material was examined and grouped for recurring themes and then was grouped accordingly into categories. Frequency of responses and percentages were calculated.

CHAPTER IV

Analysis of Data and Discussion of Findings

Introduction

This chapter contains the results of both the quantitative and qualitative analysis and discussion of the findings. Knafl and Howard (1984) have suggested that this combined approach be followed, particularly when qualitative data are included.

For purposes of clarification, the findings are organized into five major sections:

1. Personological variables.
2. The experience of learning to give an IM injection.
3. Phases of learning to give an IM injection.
4. Strategies used in learning to give an IM injection.
5. Evaluation of present teaching strategies.

Two types of displays are used to illustrate the findings: leaf and stem, and box and whisker. These are explained in detail at the time the first example of each is used.

Personological Variables Affecting Skill Acquisition

Age. While the overall age range of students in the study was from 18 years to 32 years, only 20.8% were over the age of 20 years. The mean age was 20.35. The data are presented in Display 1. A stem and leaf display, such as

Display 1, is used to "combine the visual characteristics of a histogram with the ability to recapture each of the data values. The stem is the value that appears to the left of the colon, the leaves appear to the right" (Maguire, 1985, p. 6). To obtain the original value, the leaves are attached to the stem. In Display 1, there are two rows for each stem. Leaves from 0 to 4 are in the first row, and leaves from 5 to 9 are in the second row. Looking across the third row it reads 20:000000000000112234. This means that twelve students, (indicated by the "0's"), are 20 years old, two students, (indicated by the "1's"), are 21, two students, (indicated by the "2's"), are 22, one student, (indicated by the "3"), is 23, and one student, (indicated by the "4"), is 24.

DISPLAY 1

Stem and Leaf Display for Age

(Stem: tens
Leaves: units)

```
10:
   : 88889999999999999999999999
20 : 000000000000112234
   : 589
30 : 2
```

n = 48

Does age affect the performance of psychomotor skills? Calculation of Pearson Product Moment Correlations revealed a positive relationship between age and the performance scores obtained for Injections #2 and the Final Injection given in the study (r=.21, .19), but the results were not significant. In addition, there was a positive and significant relationship between age and the time spent administering the final injection (r=.41, p=0.01) inferring that the older students took longer to give the injection. A negative relationship existed between age and anxiety (Table 1). The older students tended to be less anxious on the STAI (State) tests at the time of Injection #2 and Injection #3. On Form B (anxiety related to the steps of the IM procedure), the older students were less anxious on all four injections. There was also a negative but not significant relationship between age and anxiety with a new task (r=-.17).

TABLE 1

Correlation Between Age and Anxiety

			Injections		
Test	Interview #1	Lab	#2	#3	Final
STAI-State	-	-	-.12	-.15	.04
Form B-Injections	-.11	-.27*	-.12	-.10	-.02
Anxiety-New Task	-.17	-	-	-	-

*Significant at 0.05 level.

Of interest is the positive relationship between age and manipulative dexterity as measured by five tests of the General Assessment Test Battery (GATB) administered as pre and posttests (Table 2). On two of the GATB tests (Turn and Disassemble) given as pretests, the Pearson correlation coefficients were .41 and .42. These tests are designed to measure manual dexterity and finger dexterity respectively. When age was compared with the combined score for Place and Turn (which gives an overall score on Manual Dexterity) on the pretest, the correlation was .43. For all pre and posttests except Coordination and Assemble the correlations with age reached significance at the 0.05 level (see Table 2). The subjects were then arranged according to age into

TABLE 2

Correlation Between Age and Manipulative Dexterity

GATB test	Pretest	Posttest
Coordination	.14	.10
Place	.36*	.26*
Turn	.41*	.37*
Manual Dexterity (mean of Place & Turn)	.43*	.35*
Assemble	.22	.21
Disassemble	.42*	.28*
Finger Dexterity (mean of Assemble & Disassemble)	.36*	.29*

*Significant at the 0.05 level.

two groups. Group 1 was made up of those subjects age 20 and below; group 2 consisted of those subjects over age 20. The t-test results are presented in Appendix 15. The older group scored significantly higher on Place, Turn, Manual Dexterity (mean of Place and Turn), Disassemble, and Finger Dexterity (mean of Assemble and Disassemble). These scores were significantly different at the 0.05 level. The Coordination and Assemble scores were not significantly different. The lack of a significantly different score on Coordination appears not to support the view expressed by Kottke, Halpern, Easton, Ozel, and Burrill (1978) that normal coordination (a component of manipulative dexterity) reaches its peak between the ages of 25 to 30. However, another explanation given the significant results on other dexterity tests, is that the GATB Coordination test may not provide a sensitive enough measure of coordination. In fact, this test actually measures eye-hand coordination and motor speed, different aspects than those referred to by Kottke et al. Since coordination is a component of dexterity, the other GATB dexterity tests may also be measuring some degree of coordination.

Knowledge. The evaluation of knowledge was obtained through the use of a 16-item multiple choice test (Boyd, McKiel and Murphy, 1983) administered on two occasions.

The composition of the examination was as follows: preparation of the injection (selection of equipment, and drawing up the medication) 25%, administration of the injection (including sites, patient preparation and teaching, and principles of drug administration) 62.5%, and care of equipment and recording of the medication (safe disposal and accurate recording of the administration of the drug) 12.5%. The questions asked were consistent with the general categories used in the performance guide (Intramuscular Injection Observation Sheet by Boyd, McKiel and Murphy, 1983), and represent the important concepts related to IM injections.

On the pretest, the Kuder-Richardson 20 (KR-20) split-half type of reliability was .20, with a standard error of measurement at 1.66. On the posttest, the KR-20 was .17, with a standard error of measurement of 1.65. When adjustments were made for test length using the Spearman-Brown Prophecy Formula (Thorndike & Hagan, 1961), the reliability was .33 on the pretest, and .29 for the posttest. Both of these were lower than the .54 obtained by Boyd, McKiel and Murphy (1983) in their study of diploma nursing students. The low reliability scores raise serious doubts regarding the usefulness of this test.

There are several explanations for the low KR-20 scores. The most likely factor is that the more homogeneous a group is, the lower the reliability will be (Chase, 1978). In this study the group was similar in age and ability. The second factor involves the difficulty level of the questions (Thorndike & Hagan, 1961). When test items are difficult, more guessing occurs, thereby reducing accuracy. If the test items are too easy, the test is ineffective in discriminating among the members. If all students can do the easy items, the effect is to shorten the test to only the few more difficult items that some group members can do and some are unable to do. On the pretest, 3 out of 16 items were judged to be too difficult (difficulty index below .3), while 4 items were judged to be too easy (difficulty index above .85). On the posttest 1 item out of 16 was judged to be too difficult, while 6 items were judged to be too easy.

An additional concern involves the distractors used in the items. On the pretest, in 11 out of 16 questions, one or more of the distractors was not selected by any of the students. On the posttest this situation existed in 15 of the 16 questions.

An important measurement in item analysis is the item reliability index (IRI). This number embodies the point biserial correlation between an item and the total test score, and the difficulty of the item (proportions of students answering the questions correctly) (Ferguson, 1981). On the pretest only 9 out of 16 items had an acceptable item reliability index of .1 or better. On the posttest, 10 out of 16 items had an acceptable IRI. In this way, when only the best items are considered, the test becomes even shorter.

Test length also reduces reliability (Chase, 1978). A test with 16 items could be considered unreliable. Therefore it was appropriate to apply the Spearman Brown Prophecy Formula to adjust for the test length (Thorndike & Hagan, 1961).

Although the test would appear to have content validity, the low reliability is of some concern. Before this knowledge test can be used again considerable work is required to improve the distractors and to eliminate most of the easy items.

The means for the pre and posttests were 57.54, and 66.75 respectively, both of which were lower than expected. A summary of a one-way analysis of variance comparing the pre and posttest means is presented in Table 3. The F ratio was 21.59 and was significant at the 0.01 level. At the time of the pretest, the students' knowledge about

TABLE 3

Summary of One-Way Analysis of Variance Comparing Scores on Knowledge Test on Two Occasions: Pretest and Posttest

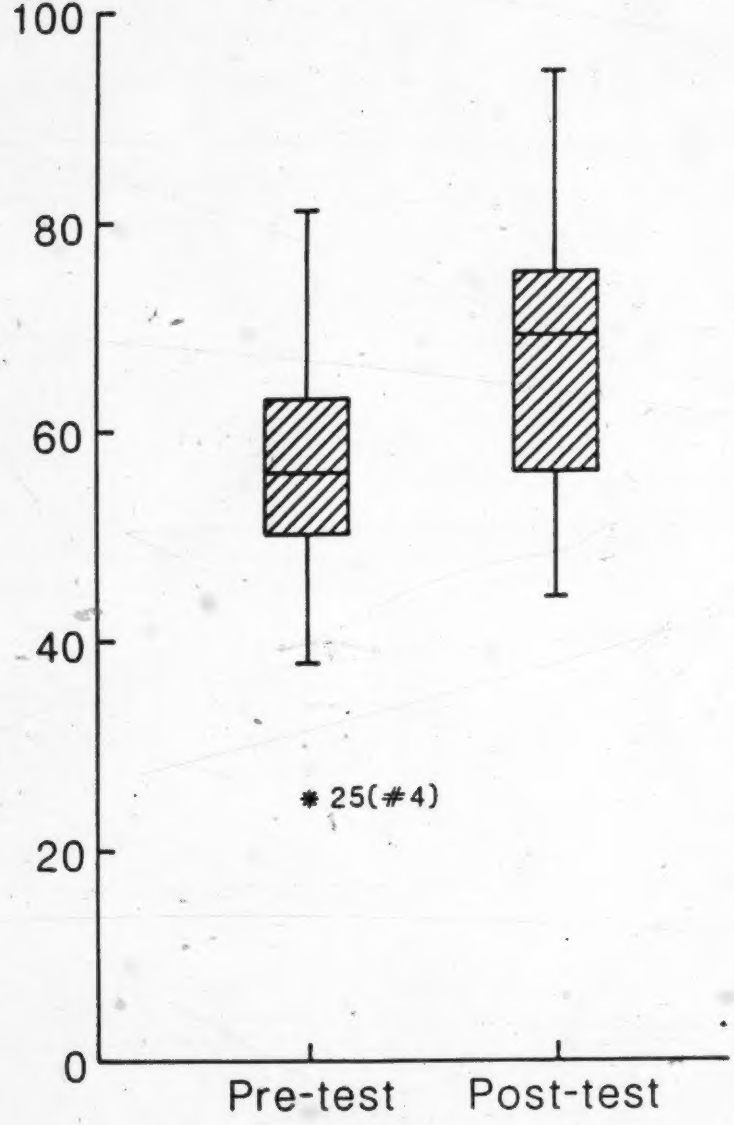
Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	8188.000	47.	174.213		
A	2035.125	1.	2035.125	21.587	0.001*
AS-WITHIN	4431.000	47.	94.277		

*Significant at 0.01 level.

injections was based primarily on the lecture presentation, the laboratory experience, and any additional reading. The significant increase in scores from the pretest to the posttest is probably as a result of the students gaining knowledge about injections from their actual experience with the procedure in the clinical area. At the time of the posttest, all the students had completed at least three IM injections, with the exception of two students, who had given only two IM injections to patients. Display 2 is an example of a box and whisker display which is a useful way to illustrate differences between test scores and to identify those students with extreme scores.

> The ends of the boxes are placed at the first and third quartiles. The line through the middle of the box is the median. The whiskers join the boxes to the extreme scores, except in cases where the extreme scores fall more than one and a half box lengths beyond the upper or lower quartiles. Such scores are marked with asterisks and are called outliers. (Maguire, 1985, p. 7)

For example, on the pretest, the median was 56%, the first quartile (lower border of the box) was at 50% and the third quartile (upper border of the box) was at 63%. The upper whisker marks the top score of 81%, while the lower whisker indicates the score closest to one and a half box lengths beyond the lower quartile (30%). In this example, the lowest score (25%) is shown by an asterisk, indicating that this student (#4) is an outlier. On the posttest example, the median is 69%, the first quartile is 56% and the third



DISPLAY 2

Box and Whisker Display for
Knowledge Test: Pretest and Posttest

quartile is 75%. The upper score is 94% and the lowest score is 44%.

Analysis of Pearson Correlation Coefficients shows a negative relationship between knowledge about injections (pretest) and the Time taken to Prepare and Administer Injection #2, and the Preparation Score on Injection #2 (r = -.16, -.16, -.06). There is also a negative relationship between the posttest knowledge scores and the Time taken to Administer the Final Injection, the Equipment and Recording Score, and the Total Performance Score (r = -.08, -.18, -.06).

The t-tests comparing the top one-third students with the lower one-third students on the knowledge pre and posttest showed no significant differences between the groups on the performance of Injections #2 and #3 and the Final Injection. These findings are consistent with those obtained by Boyd, McKiel and Murphy (1983) in that knowledge about injections and asepsis does not appear to affect performance of injections. Brown and Calder (1986) in a study comparing instructional strategies also found that the performance of a nursing skill (palpation of the pregnant abdomen) was not positively related to knowledge of the procedure.

After the final injection, the clinical instructors evaluated the students' knowledge about injections and asepsis by completing a 5-point rating scale (see Table 4).

The majority of the students were rated as a 4 (very good: 47.83%), or a 5 (extremely good: 15.26%).

TABLE 4

Instructor Rating of Students' Knowledge at the Time of the Final Injection

	Scale (1-5) Frequency of Responses and Percentage					
	1	2	3	4	5	Total
	None	Some	Moderate	Very Good	Extremely Good	
f	0	1	16	22	7	46*
%	0	2.17	34.78	47.83	15.22	100.00

*Missing Cases: 2 students failed Nursing 320

Academic Achievement. The grade in the course the students were taking while in the study was assigned on a 9-point scale. The mean was 6.08 and the standard deviation was 1.15. Display 3 shows the distribution of grades for Nursing 320.

DISPLAY 3

Stem and Leaf Display for Grade in Nursing 320

(Leaf : units)

```
0 :
  :
  : 2
  : 3
  : 44
  : 55555
  : 666666666666666666666
  : 7777777777777777
  : 88
```

n=48

The grade (as a percentage) from a practical examination involving fine and gross motor skills in the manipulation of equipment, completed in the first year of the nursing program, was also obtained. The mean was 79.54 and the standard deviation was 11.63. The distribution of grades is shown in Display 4. A significant relationship between this grade and the grade point average for second year students was noted (r = .25, p. = .05).

DISPLAY 4

Stem and Leaf Display for Grade in Practical Examination

(Stem : tens
Leaves : units)

```
50 : 00
   : 889
60 : 24
   : 8
70 : 01133
   : 5677899
80 : 11233444
   : 566677789999
90 : 0023334
   : 5
```

n=48

The grade point average for the second year of the baccalaureate nursing program was calculated on a 9-point scale. The mean was 6.14, with a standard deviation of .72. The distribution is shown in Display 5.

DISPLAY 5

Stem and Leaf Display for Grade Point Average

(Stem : units
Leaf : tenths)

4 : .3
: .8
5 : .0.1.2.2
: .5.6.6.7.7.7.8.8.8.8.8.8.9.9
6 : .0.0.0.0.1.1.1.2.2.3.4
: .5.5.5.5.6.6.7.7.9.9
7 : .0.1.1.2.3
: .5.9

n=48

The correlation between the grade in the course Nursing 320 and grade point average for second year was .78 and was significant at the .01 level. This strong relationship is partially explained by the fact that the course contributes a weighting of six towards the grade point average. One other major nursing course in second year has a weighting of 5. When grade point averages for second year were compared with instructor ratings of ability to give IM injections independently, the relationship was significant (r = -.32, p = 0.01). Those students with higher grade point averages were less likely to be allowed to give IM injections on their own.

The t-tests comparing the top one-third students academically with the lower one-third students (based on grade point average) produced a significant difference in relation to the Equipment and Recording score on Injection #2 ($t = 2.18$, $df = 33$, 2-tail probability = 0.04 [pooled variance estimate]). No significant differences were noted on tests of Coordination, Manual Dexterity, and Finger Dexterity. Therefore these findings do not support Ismail and Gruber's study (1967) that identified a relationship between academic achievement and coordination, or the General Aptitude Test Battery (1970) validation studies that found a significant relationship between grade point average and finger dexterity.

Manipulative Dexterity. The mean aptitude scores for the three GATB aptitudes (Coordination, Manual Dexterity and Finger Dexterity) are shown in Table 5. It is apparent that the mean aptitude scores on the three dexterity aptitudes improved from the pretest to the posttest situation, and analysis of variance supports the differences as being significant. However, it is necessary to consider the practice effect that occurs with taking the test on the first occasion. The practice effect is most apparent immediately after the initial exposure, decreases until 26 weeks, and then stabilizes at that level for up to three years (GATB, 1970, p. 274). The posttest in the present study was given 11 weeks after the pretest. The results from tests conducted on the practice effect of the GATB dexterity aptitudes demonstrate that an increase in mean scores of 7.9 (Coordination), 6.3 (Manual Dexterity), and 8.2 (Finger Dexterity) can be expected (GATB, 1970, p. 266). When these increases are added to the pretest aptitude mean scores, the results are similar to the actual aptitude mean scores obtained on the posttest for Manual Dexterity and Finger Dexterity, suggesting that improvement could be explained by the practice effect (see Table 5). However, the Coordination posttest aptitude mean score is higher than the score expected due to the practice effect, suggesting that some improvement in performance occurred.

TABLE 5

General Assessment Test Battery Scores (GATB) Aptitude Scores: Pretest and Posttest

(Raw scores have been converted to aptitude scores)

Aptitude	Pretest Mean	Expected Increase (Practice Effect)	Expected Result (Practice Effect)	Posttest Mean
Coordination	76	7.9	83.9	90
Manual Dexterity	77	6.3	83.3	83
Finger Dexterity	48	8.2	56.2	56

Students taking the GATB tests were asked if they had taken (within 24 hours) any medication, such as antihistamines, that could cause drowsiness and thereby decrease dexterity and coordination. The results of the study suggest that the opposite effect occurred; on the pretest, those on medication scored higher than those not on medication. The difference was significant at the 0.05 level for Finger Dexterity on the pretest (t=-2.23, df=46, [pooled variance estimate]). When the performance of individual students who were on medication for one, but not for both of the dexterity tests, was compared the differences between the pre and posttest scores (taking into account the practice effect) were no different than those achieved by the students who are not on medications.

When compared with the GATB General Working Population sample, and the Professional and Semi-professional workers sample, the subjects in this study scored higher on all five of the tests (Table 6) (GATB, 1970, p. 23-25). Of particular note is the fact that on the Coordination test the mean score was 39.37 points above the mean score attained by the GATB General Working sample population and 35.3 points above the mean score attained by the Professional and Semi-professional sample.

TABLE 6

Comparison of Students' Pretest GATB Scores with the GATB Working Population Sample Scores and the Professional and Semi-professional Workers Sample Scores (Raw Scores)

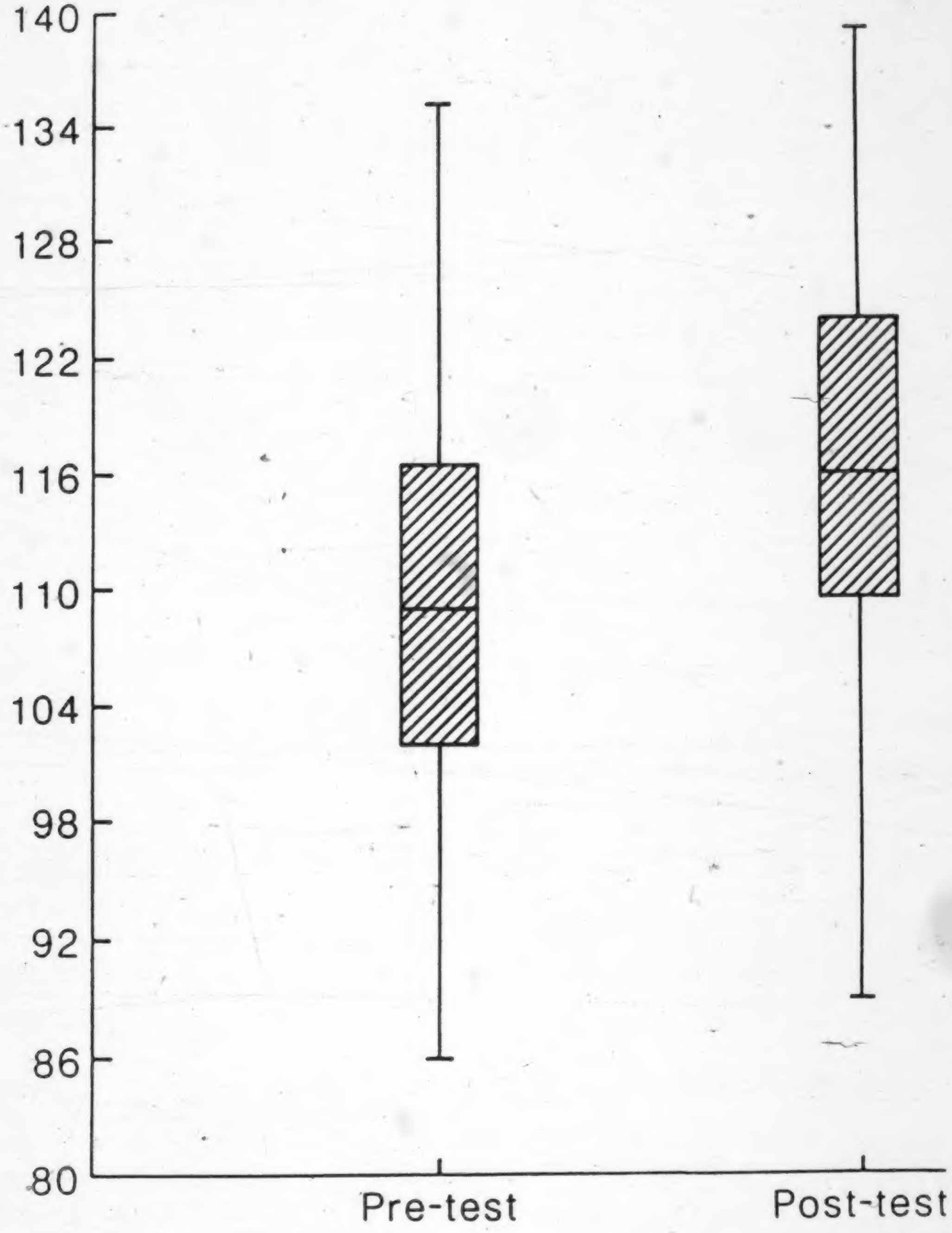
Test	GATB Working Population Sample		Professional and Semi-professional Sample		Study Sample	
	Mean	SD	Mean	SD	Mean	SD
Coordination	69.5	10.3	73.6	10.9	108.9	10.9
Place	89.8	8.6	93.5	8.3	94.5	7.5
Turn	100.9	9.7	102.4	9.5	106.9	9.0
Assemble	28.3	4.6	29.1	4.4	29.7	4.0
Disassemble	29.5	3.7	29.5	3.6	32.1	3.2
Age (years)	30.4	9.9	28.9	8.1	20.4	2.8
Education (years)	11.0	2.6	14.4	2.6	13.83	1.6

From the box and whisker display of Coordination scores (Display 6) it can be seen that the range on the pretest was 86 to 135, and the range on the posttest was 89 to 139. No outliers are present. However, the GATB standards for general duty nurses specifies a score of 95 as the minimum acceptable Coordination score (GATB, 1972, p. 187). Six students were below the level on the pretest (#1, #8, #22, #30, #44 and #48). On the posttest, three of these students showed improvement but still remained below 95 (#1, #8, and #22). In additon, the mean of the

Coordination pretest (109) is low when compared with the mean from a sample of general duty nurses (116) (GATB, p. 147).

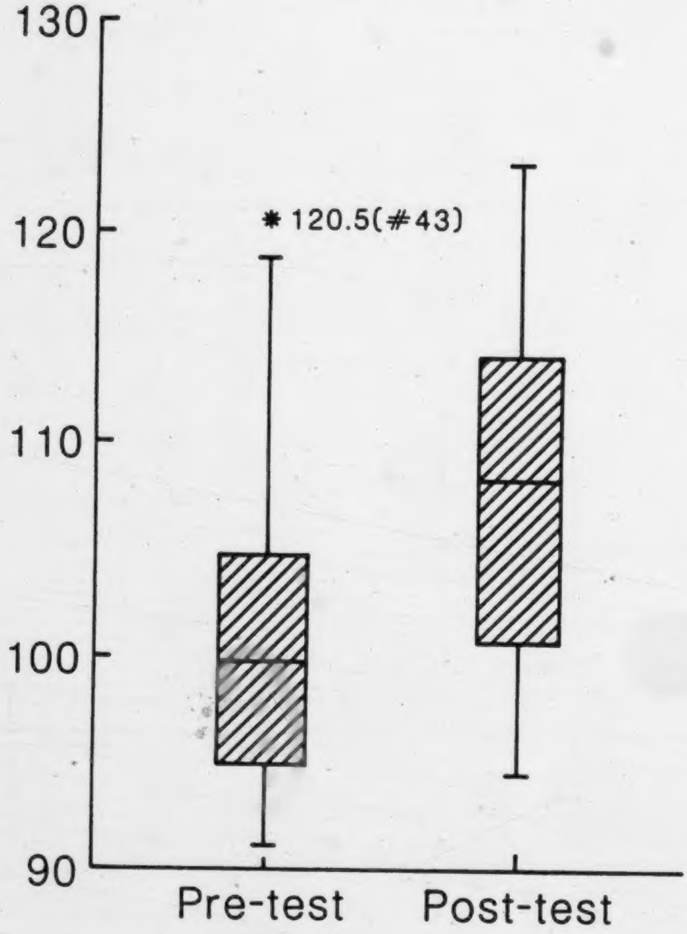
On the display of Manual Dexterity scores (Display 7), the pretest range was 91 to 120.5, while the posttest range was 94.5 to 123. One outlier (student #43) is present on the pretest but her score is only slightly higher than the rest of the group. The range of Finger Dexterity scores on the pretest was 25.5 to 38 and on the posttest was 27.5 to 44 (Display 8). The total possible score on Finger Dexterity is 50. From the box and whisker display one outlier is noted on the posttest (student #34) and this score is considerably higher than the next highest score of 39.

When the students with the highest scores on the Coordination pretest (top one-third) were compared with the students with the lowest scores (lower one-third), significant differences ($p = 0.05$) were noted in relation to the Administration score and the Final score of Injection #3 (see Table 7).



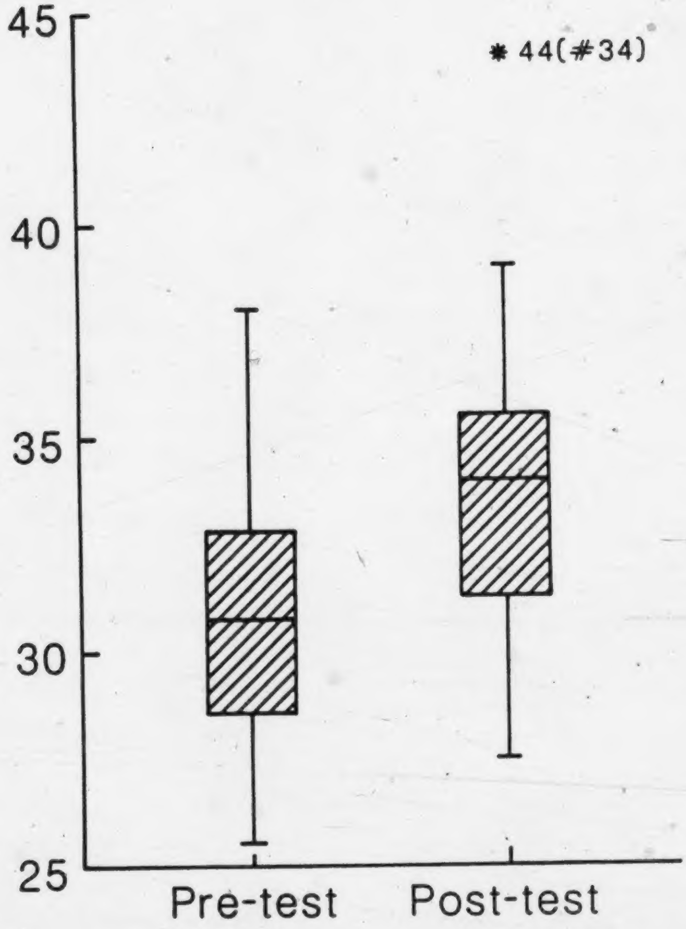
DISPLAY 6

Box and Whisker Display for
Coordination (GATB)



DISPLAY 7

Box and Whisker Display for
GATB Manual Dexterity Scores



DISPLAY 8

Box and Whisker Display for
GATB Finger Dexterity Scores

TABLE 7

t-test Results of Coordination - Performance Scores

			Pooled Variance Estimate		
	Mean Score	S.D.	t-value	df	2-tail Prob.
Administration					
Score-Inj #3					
high group	90.75	5.48	2.28	30	0.03*
low group	85.31	7.82			
Total Score					
Inj. #3					
high group	91.25	4.89	2.25	30	0.03*
low group	87.31	5.00			

*significant at 0.05 level

Similar groupings of students in relation to manual dexterity and finger dexterity did not produce any significant differences.

Pearson correlations coefficients were calculated to determine relationships within the dexterity tests and with other variables. High correlations were obtained when each pretest was compared with the corresponding posttest (see Table 8). There was a significant relationship (p = 0.01) between the manual dexterity pretest scores and the time taken to administer the final injection (.44). The more dextrous students took longer to give the injection. There was also a significant correlation between finger dexterity pretest scores and the students' description of their dexterity (.41, p = 0.01).

TABLE 8

Pearson Correlation Coefficients: Dexterity

Variable	Variable	Correlation	Prob.
Coordination-pretest	Coordination-posttest	.93	.000*
Coordination-posttest	Manual dexterity-posttest	.42	.001*
Place-pretest	Place-posttest	.73	.000*
Turn-pretest	Turn-posttest	.77	.000*
Manual dexterity-pretest	Manual dexterity-posttest	.80	.000*
Manual dexterity-pretest	Finger dexterity-pretest	.56	.000*
Manual dexterity-pretest	Time Administer Final Injection	.44	.001*
Manual dexterity-posttest	Finger dexterity-posttest	.55	.000*
Assemble-pretest	Assemble-posttest	.58	.000*
Assemble-pretest	Disassemble-posttest	.42	.001*
Disassemble-pretest	Disassemble-posttest	.56	.000*
Finger dexterity-pretest	Finger dexterity-posttest	.67	.000*
Finger dexterity-pretest	Self description dexterity	.41	.002*

*significant at 0.01 level

Correlations between the number of activities done (crafts, musical instruments, and work-related activities such as typing and cashiering) and performance were significant for some aspects of the three injections. Those students with higher numbers of activities tended to have higher Equipment and Recording Scores on Injection #3 ($r = .33$, $p = 0.01$), took longer to administer the Final Injectin ($r = .26$, $p = 0.05$), have higher Administration Scores on the Final Injection ($r = .30$, $p = 0.02$), and have lower Preparation Scores on the Final Injection ($r=-.24$, $p = 0.06$).

At the time of the first interview, the students were asked to describe themselves in relation to manual dexterity or coordination. The responses were coded and organized into four groups (poor, average or fair, good, and careful). A majority of the students (56.25%) described themselves in positive terms and rated their dexterity as good. They used words such as "competent", "coordinated", "proficient" and "skillful". Six students (12.5%) described themselves in negative terms such as "pretty clumsy", "awkward", and "not very good". An additional 27.08% (13) rated themselves as "average" or "fair", while 4.17% (2) described themselves as "careful". When asked to rate themselves as skillful versus not skillful (scale of 1-5) 2 students (4.17%) rated themselves as only "somewhat skillful", while 27 students (56.25%)

rated themselves as "moderately skillful", and 19 students (39.58%) rated themselves as "very skillful".

After completing the Final Injection in the study, the students were asked to rate how skillful they were in relation to preparing and administering IM injections. Ten students (22.73%) rated themselves as "moderately skillful" at preparing injections, whereas 29 students (65.91%) rated themselves as "very good" and 5 students (11.36%) rated themselves as "extremely good". The four missing cases included the two Nursing 320 failures and two students who omitted answering the questions. In relation to administering IM injections, it is interesting to note that 20 students (43.48%) rated themselves as "moderately skillful", and 23 students (50%) rated themselves as "very good" while 3 students (6.52%) rated themselves as "extremely good". The lower rating for skill in administering IM injections may indicate some hesitancy or lack of confidence in ability to actually administer the injection. Students at this point are still learning the skill.

The clinical instructors evaluted each student's skill in preparing and administering the final IM injection (Table 9). The instructors rated 43 students (93.50%) as being "moderately skillful" or better. The student rated as "not at all skillful" (#47) received a failing grade in the Spring Session course. When the students' ratings for both preparation and administration were combined into a single score to allow for comparison with the instructor ratings, all 46 students (100%) rated themselves as being "moderately skilled" or better. The three subjects given the lowest scores by the instructors did not give themselves similarly low scores.

TABLE 9

Instructor Rating of Skill Level: Final Injection

	Scale (1-5) 1	2	3	4	5	Total
	Not At All	Somewhat	Moderately So	Very Good	Extremely Good	
Frequency	1	2	12	24	7	46*
Percentage	2.17	4.35	26.08	52.17	15.22	100.00

Mean 3.74
S.D. .86
*Missing Data: 2 students failed Nursing 320

Anxiety. The State-Trait Anxiety Inventory (STAI) - Trait scale was given as a pretest. The distribution of scores is presented in Display 9.

DISPLAY 9

Stem and Leaf Display for STAI-Trait Anxiety Scores

```
(Stem : tens
 Leaf : units)

Possible Range of Scores = 20 to 80

20 : 3
   : 67
30 : 011112223333344
   : 666666778889
40 : 0000011122
   : 558899
50 : 0
   :
60 : 1

Mean = 37.58
S.D. =  7.034
n = 48
```

The mean for female undergraduate college students as established by Spielberger et al. (1970) is 38.25, and the standard deviation is 9.14. The students in this current study generally were slightly less anxious than the test sample.

A strong negative relationship was found to exist between STAI-Trait scores and most of the self-esteem scores from Battle's Culture-Free Self-Esteem Inventory (1981). For example, the correlation between STAI-Trait and general self-esteem, personal self-esteem, and the total self-esteem scores were all significant (p = 0.01) on both the pretest and the posttest (Table 10).

TABLE 10

Pearson Correlation Coefficients:
STAI-Trait Scores

	Self-Esteem Inventory Tests	Correlation
STAI-Trait	Self-Esteem (general) pretest	-.49*
	Self-Esteem (general) posttest	-.35*
	Self-Esteem (personal) pretest	-.52*
	Self-Esteem (personal) posttest	-.51*
	Self-Esteem (total) pretest	-.55*
	Self-Esteem (total) posttest	-.44*
	Self-Esteem generally at Interview #1	-.56*

*significant at 0.01 level

There was a significant relationship between STAI-Trait scores and the knowledge posttest scores (r = .43, p = 0.01). Those with high trait anxiety scores had higher scores on the knowledge posttest. Generally it would be expected that these anxiety-prone students might have lower scores in a testing situation.

Another statistically significant correlation (at 0.05 level) was between STAI-Trait and the number of IM injections given (r=.44). The total number of injections given is primarily dependent upon the student's assigned clinical area. It is somewhat dependent upon the initiative of the student to take advantage of every opportunity to give an injection. If students were anxious they would either try to avoid giving injections or might seek out additional experiences in an attempt to master the skill and therefore reduce anxiety.

The correlation between STAI-Trait and STAI-State on the pretest was .53 and was significant at the 0.01 level. The correlation obtained is consistent with those reported by Spielberger et al. (1970, p. 12), which ranged between .44 and .55, depending upon the amount of threat to self-esteem present in the situations used for the state items. The correlation obtained is consistent with the view that high trait anxiety individuals tend to over respond to changing situations, resulting in high state anxiety scores. The STAI-State items were given as a pretest, and at the time of Injection #2, #3, and the Final

Injection. The means and standard deviations are shown in Table 11.

TABLE 11

Test Results for STAI-State on Four Occasions

	Mean	Standard Deviation	Cases
Pretest	34.58	7.34	48
Injection #2	40.77	10.06	48
Injection #3	37.58	8.86	48
Final Injection	36.17	9.95	46*

*Missing Data: 2 students failed Nursing 320

A one-way analysis of variance comparing the STAI-State responses on the four occasions resulted in an F ratio of 7.424 which was significant at the 0.01 level (Table 12).

TABLE 12

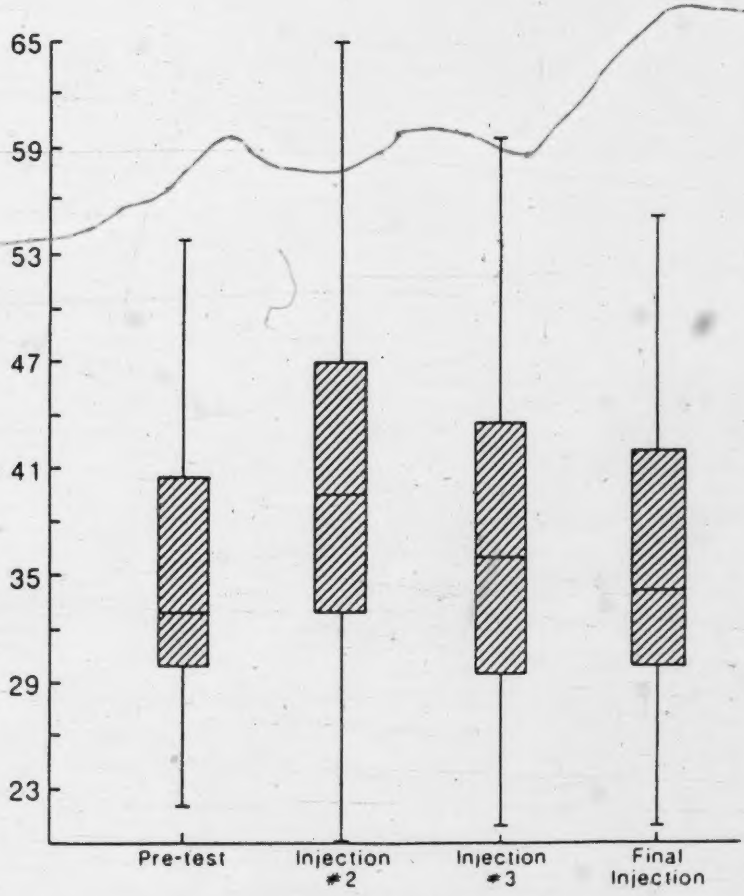
Summary of One-way Analysis of Variance Comparing State-Trait Anxiety Inventory (State) Reponses on Four Occasions: Pretest, Injection #2, Injection #3, and Final Injection

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	9091.625	45.	202.036		
A	1026.555	3.	342.185	7.425	0.001*
AS-WITHIN	6221.813	135.	46.087		

*significant at 0.01 level

On the box and whisker display (Display 10) it is readily apparent that anxiety scores increased with Injection #2 (over the relatively calm classroom environment of the pretest), and then decreased with Injection #3 and the Final Injection. The score on the Final Injection is somewhat surprising in that, for many of the students, that injection was given in an unfamiliar clinical setting, early in the Spring Session course. The fact that the level of anxiety was lower than for Injection #2 and #3 could be interpreted to mean that the students were becoming less anxious about the IM injection procedure per se, and they were thus able to cope with the newness of the setting without an increase in anxiety levels. While there was a considerable range of scores on each occasion (pretest range 22 to 54, Injection #2 range 20 to 65, Injection #3 range 21 to 60, and Final Injection range 21 to 55), no outliers are present. The changing scores across occasions would indicate that the STAI-State is sensitive enough to detect differences in injection situations.

The one-third most anxious students based on the STAI-State scores for each injection were compared with the one-third least anxious students in relation to performance scores on each injection. A significant difference between groups was found for the Time taken to Administer Injection #3. The most anxious students gave the injection in less



DISPLAY 10

Box and Whisker Display for
STAI-State Response on Four Occasions

time than the least anxious students (t = 2.15, df = 20, 2-tail probability = 0.04 [pooled variance estimate]). Perhaps these anxious students dealt with their anxiety by trying to get the stressful event over with as quickly as possible.

A significant negative relationship (at the 0.01 level) was found between STAI-State scores and self-efficacy. High state anxiety scores on Injection #2 and the Final Injection were related to low-self efficacy scores reported at the time of the third interview (-.44 and -.58). Similar significant negative correlations were noted between STAI-State scores on Injection #3 and self-efficacy at Injection #3 (-.34) and the Final Injection (-.51), and between STAI-State on the Final Injection and self-efficacy on the Final Injection (-.50) and at Interview #3 (-.58). When the STAI-State scores for Injection #2, #3 and the Final Injection were compared with the students' self rating (at Interview #3) of "being able to do most things in nursing" significant negative relationships were noted (Injection #2, r = -.38; Injection #3, r = -.33; and the Final Injection, r = -.35, p = 0.01).

Generally, the relationship between state anxiety and SEI self-esteem scores was a negative one but none was significant. STAI-State anxiety scores at the Final Injection were negatively related to the students' self-reported level of self-esteem in relation to injections at the time of the third interview (-.44, significant at the 0.01 level).

When STAI-State scores (Final Injection) were compared with students' self-reported skill in preparing and giving IM injections (Interview #3), the results were significant at the 0.01 level (preparing: $r = -.57$, giving: $r = -.44$). The higher the anxiety, the lower the reported skill levels. A similar significant negative relationship was noted between STAI-State scores (Final Injection) and reported confidence in relation to preparing and giving injections (-.46 and -.50, $p = 0.01$). High state anxiety scores on the final injection were also related to lower skill scores as assigned by the instructors at the time of the Final Injection ($r=-.45$, $p = 0.01$).

Form B was designed to assess anxiety specifically in relation to the various steps of the IM injection procedure. This Form was administered to the students on six occasions: Interview #1, Laboratory Injection, Injection #2, Injection #3, Final Injection, and Interview #3. The means and standard deviations for each occasion are contained in Table 13. There is a steady decline in

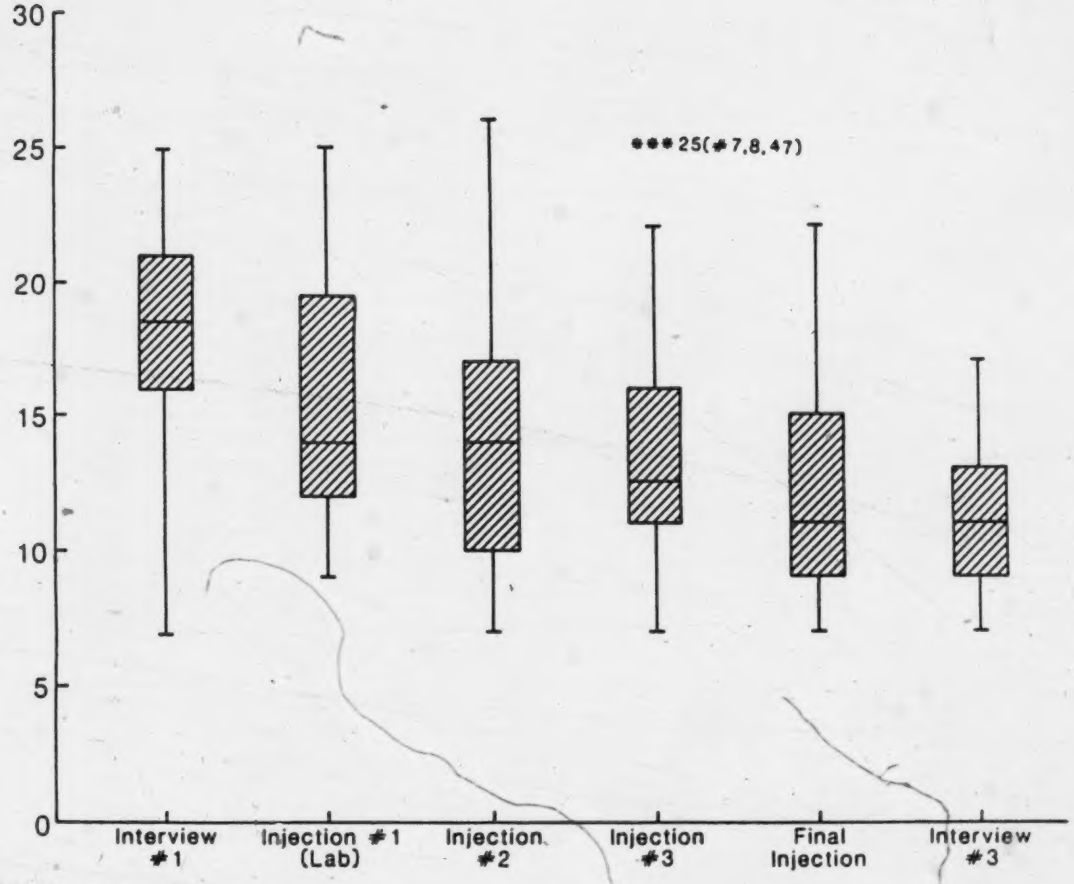
TABLE 13

Means and Standard Deviations of Responses on Anxiety Related to Injections (Form B) on Six Occasions: Interview #1, Laboratory Injection, Injection #2, Injection #3, Final Injection and Interview #3

	Mean	S.D.	Cases
Interview #1	18.39	3.07	44*
Laboratory Injection	15.27	4.83	44
Injection #2	13.46	3.82	44
Injection #3	12.75	3.70	44
Final Injection	12.11	3.64	44
Interview #3	11.36	2.69	44

*Missing Data: 2 students failed Nursing 320
2 missing responses on one occasion

the reported anxiety over the six occasions. The highest scores at the time of Interview #1 could be due to the fact that students were asked to assess their anxiety level as if they were required to do an injection at that point in time. Since this was done prior to the lecture or any readings about injections the results probably reflect a lack of knowledge about injections. By the time of the laboratory injection, the knowledge level had likely increased and the students reported that the laboratory atmosphere was supportive. An analysis of variance of the scores for the six occasions showed a significant difference at the 0.01 level (F ratio = 32.548, df = 5, 215) (Table 14). On the box and whisker



DISPLAY 11

Box and Whisker Display for
Scores on Form B-Anxiety on Six Occasions

TABLE 14

Summary of One-way Analysis of Variance Comparing Scores on Anxiety Related to Injections (Form B) on Six Occasions: Interview #1, Laboratory Injection, Injection #2, Injection #3, Final Injection and Interview #3

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	1579.586	43	36.735		
A	1458.886	5	291.777	32.548	0.001*
AS-WITHIN	1927.348	215	8.964		

*significant at 0.01 level

display, the reduction in anxiety level across the six occasions is readily apparent (Display 11). On Injection #3 there are three outliers with a score somewhat higher than the other students (Student #8, Student #17, and Student #47).

A more detailed summary of the frequency of responses and percentages for Form B in relation to the four injection occasions is contained in Appendices 16 through 19. For most of the components of the IM procedure there was a shift from higher levels of anxiety to lower levels by the time of the Final Injection. In relation to Preparing the Patient and Landmarking, there was a movement from the two outer ends of the scale towards the middle. For example, by the Final Injection, fewer students selected "1" (not at all anxious) about preparing the patient, than they did at the time of the Laboratory Injection, or Injection #2 or #3. This may suggest that as students become more confident with the technical aspects of the IM procedure they are able to focus more attention on the complexities of preparing a wide variety of patients for the injection experience.

The t-test comparisons of the one-third of the students with the highest scores on Form B with the one-third of the students with the lowest scores on Form B did not result in statistically significant differences in the performance of any of the injections. Generally, the most anxious students took more time to prepare and adminster Injection #2, but obtained higher performance scores for Preparation, Administration, Equipment and Recording, and Total Score. On Injection #3, the most anxious students took less time to prepare the injection, but more time to administer the injection. Performance scores for the four parts of the procedure were lower for the anxious students. However, the differences were not significant. On the Final Injection, the most anxious students again took longer to prepare and administer the injection, but achieved higher scores on all the performance scores. This finding supports the premise that a certain amount of anxiety may actually improve performance (Captain, 1984).

Generally, there was a strong correlation between Form B (anxiety related to injections) and the STAI-State items used at the time of each injection. For example, for Injection #2 the correlation was .51, for Injection #3 the correlation was .35, and for the Final Injection the correlation was .70 (all significant at the 0.01 level). These correlations suggest that the STAI-State and Form B are measuring similar things.

Form B scores were negatively related to self-efficacy scores, particularly at the time of Interview #1 and Interview #3 (r = -.47 and -.63 respectively). Negative relationships between Form B and self-esteem were also noted. For instance, when Form B scores were high on the Final Injections, self-esteem scores were low (r = -.43, significant at the 0.01 level).

In relation to performance, high Form B scores on Injection #2 were significantly related to low scores on the Administration and the Total score for Injection #2 (-.41 for both, p = 0.01). At the Final Injection there was a strong positive relationship between Form B scores and the Time it took to Prepare the Final Injection (r = .44, p = 0.01).

Correlations between the Form B scores on the Final Injection and self-rated scores for skill in giving and preparing injections and confidence in giving injections were all significant at the 0.01 level. These correlations were: skill in preparing injections (-.43), skill in giving injections (-.51), and confidence in giving injections (-.53). In other words, the more anxious the students were on the Final Injection the lower they rated their skill and level of confidence. There was also a significant negative relationship between Form B scores and the instructor's rating of the student's skill level on the Final Injection ($r = -.44$, $p = 0.01$).

When students were asked to rate, on a scale from 1 to 4, the amount of anxiety usually experienced with having to perform a new task, 43.8% indicated that they are "somewhat" anxious (rating of 2), 29.2% are "moderately" anxious (rating of 3), and 27.1% are "very" anxious (rating of 4). The mean was 2.83 and the standard deviation was .83.

Additional student comments about anxiety will be discussed in the section describing the experience of learning to give IM injections.

Self-Esteem. Self-Esteem was measured at the beginning and end of the study by using the Culture-Free Self-Esteem Inventory (SEI) for Adults developed by Battle (1981). A slight decrease in the mean from 27.04 on the pretest to 26.89 on the posttest is noted. Battle's classification of adult SEI scores (1981, pp. 54-55) is found in Table 15 and 16.

TABLE 15

Battle's Classification of SEI Scores: Adult

Score	Classification
30+	Very high
27-29	High
20-26	Intermediate
15-19	Low
14-	Very low

TABLE 16

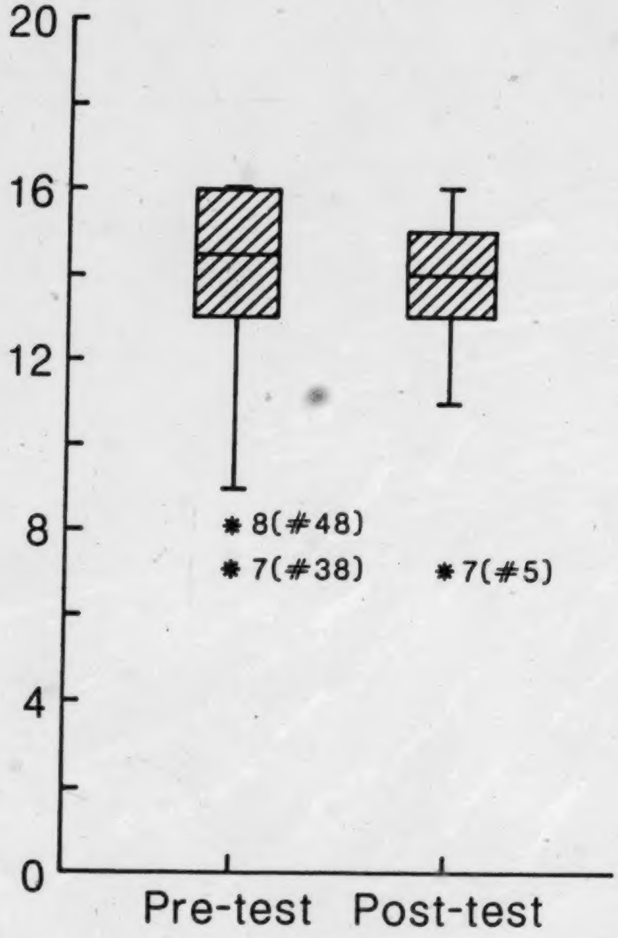
Battle's Classification of SEI Subscale Scores: Adult

Scale	Very High	High	Intermediate	Low	Very Low
General	15+	12-14	8-11	5-7	4-
Social	8	6-7	4-5	2-3	1
Personal	8	6-7	4-5	2-3	1

The pretest mean falls within the category of "high" self-esteem. By the time of the posttest, although the mean was only slightly lower, it is at the borderline between "high" and "intermediate" self-esteem. Box and whisker displays for the subscale tests (pretest and posttest) are presented in Displays 12, 13, and 14. General Self-Esteem subscore means of 13.82 (pretest) and 13.83 (posttest) would be classified as "high" self-esteem. However, despite the high self-esteem of the group, Student #38 is rated as having "low" self-esteem, on the pretest, while Student #5 is rated as having "low" self-esteem on the posttest. Student #48 is rated as having "intermediate" self-esteem on the pretest (Display 12).

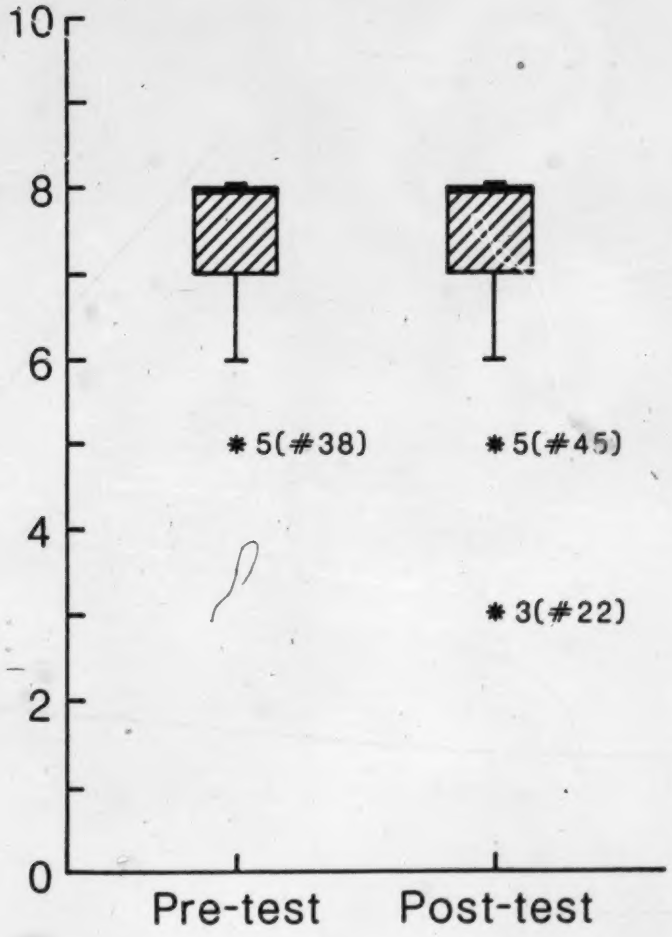
The Social Self-Esteem means 7.62 (pretest) and 7.48 (posttest) would be classified as "high" self-esteem. Several students are considerably lower than the group mean (Display 13). Student #38 would be ranked as having "intermediate" self-esteem on the pretest. Student #22 received the lowest score on the posttest, and would be described as having "low" self-esteem. Student #45 would be rated as having "intermediate" self-esteem on the posttest.

The Personal Self-Esteem means of 5.60 (pretest) and 5.69 (posttest) would be classified as "intermediate" self-esteem (Display 14). On the basis of the pretest score, Student #5 and Student #38 would be rated as having "very low" self-esteem. Despite the fact that Student #38 was in the process of failing Nursing 320, she evaluated her self-esteem at the time of the posttest at a level consistent with an "intermediate" self-esteem ranking and is no longer shown as an outlier on the posttest. This can



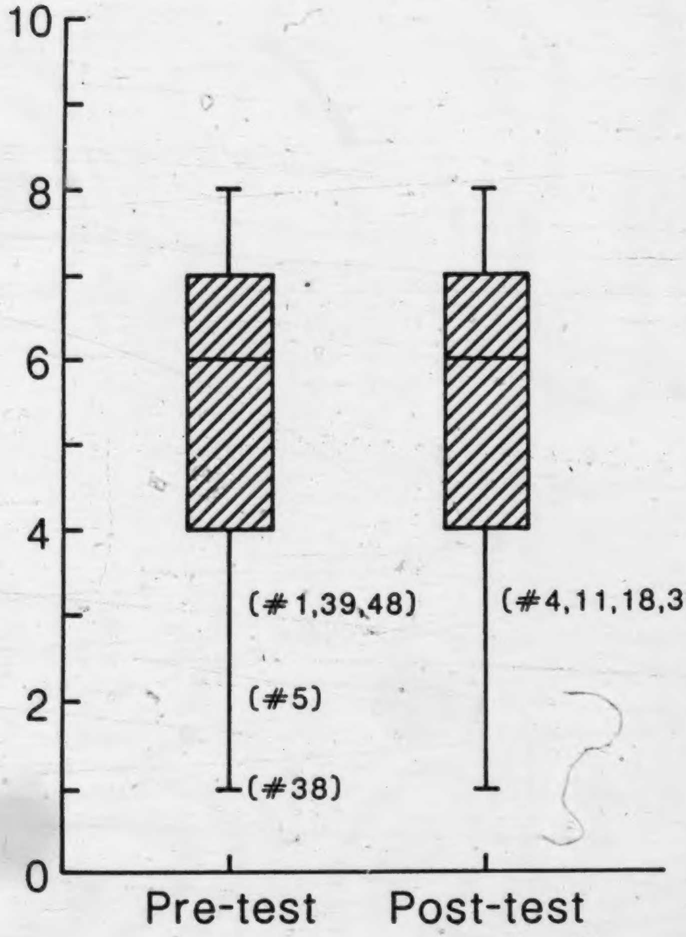
DISPLAY 12

Box and Whisker Display for
Self-Esteem (SEI-General)



DISPLAY 13

Box and Whisker Display for
Self-Esteem (SEI-Social)



DISPLAY 14

Box and Whisker Display for
Self-Esteem (SEI-Personal)

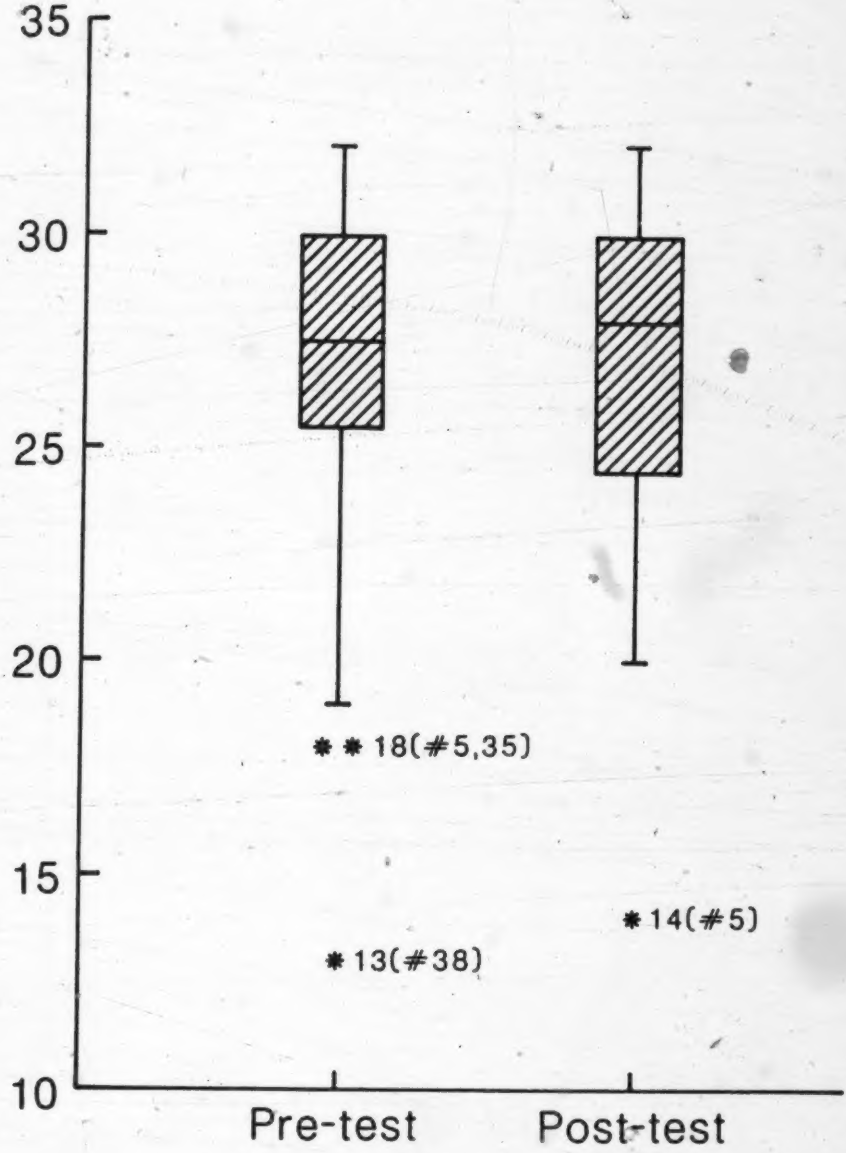
be explained by Aronson (1959) (cited in Coopersmith, 1967) who has suggested that people are unwilling to "accept evidence that they are better or worse than they themselves have decided, and generally resolve any dissonance between the evidence and their judgement in favor of their customary judgement" (p. 5). Students #1, #39, and #48 would be rated as having "low" personal self-esteem on the basis of the pretest scores. On the posttest, Students #4, #11, #18, and #36 were rated as having "low" personal self-esteem. In summarizing the data related to personal self-esteem on the pretest, 11.1% of the scores would be classified as indicating "very low" or "low" self-esteem (Table 17). An additional 26.7% of the scores would be rated as indicating "intermediate" levels of self-esteem. On the posttest, 4.2% of the scores would be classified as "very low", 8.3% would be rated as "low, and 25% would be rated as "intermediate" self-esteem. Generally speaking, the total study sample rated high on general and social self-esteem. A greater number of low scores were noted in relation to personal self-esteem. This finding can be explained in terms of the age of the students in the study and their location in the educational program. Research findings support the position that in the first and second years of a nursing program students in their late teens and early twenties are working on the stressful task of further developing their own personal identities (Fox and Diamond, 1965; Elfert, 1976; and Zujewskyj and Davis, 1985).

Analysis of variance revealed no significant differences between the total SEI pretest and posttest scores (F ratio = 0.092, probability = 0.8). A box and whisker display (Display 15) illustrates the lack of difference between the scores, and also identifies those students with significantly low scores (Student #5, #35, and #38). Coopersmith (1967) has suggested that at some point before middle childhood, an individual makes a general appraisal of his or her worth, which then remains quite stable over a period of several years.

TABLE 17

Classification of Students' SEI Subscale Scores (in Percent)

Subscale	Very Low	Low	Intermediate	High	Very High
PRETEST					
General Self-Esteem	0	2.2	8.9	40.0	48.9
Social Self-Esteem	0	0	2.2	26.7	71.1
Personal Self-Esteem	2.2	8.9	26.7	48.9	13.3
POSTTEST					
General Self-Esteem	0	2.1	8.3	48.0	41.7
Social Self-Esteem	0	2.1	2.1	31.3	64.6
Personal Self-Esteem	4.2	8.3	25.0	50.0	12.5



DISPLAY 15

Box and Whisker Display for
Self-Esteem (SEI-Total) on Two Occasions

Comparisons were made between the one-third of the students with the highest self-esteem and the one-third with the lowest self-esteem (based on the total SEI pretest scores) and performance on Injection #2 and #3 (Appendix 20). Several significant differences were noted on Injection #3. Those students with high self-esteem gave the injection in less time and they also achieved higher performance scores on preparation and overall total ($t = 2.30$, $df = 29$; $t = 2.07$, $df = 29$, both significant at the 0.05 level). Based on the total SEI posttest scores (the one-third highest and the one-third lowest), comparisons were made in relation to performance on the final injection. No significant differences were noted.

When the total SEI and subscale pretest scores were compared with the corresponding posttest scores, significant correlations were obtained (see Table 18).

TABLE 18

Pearson Correlation Coefficients: SEI Pretest and Posttest

Pretest	Posttest SEI General	SEI Social	SEI Personal	SEI Total Test
SEI General	.56*			
SEI Social		.67*		
SEI Personal			.62*	
SEI Total Test				.60*

*significant at 0.01 level

A correlation of .55 was obtained between the total SEI pretest scores, and the students' rating of their level of self-esteem at the time of the first interview (significant at the 0.01 level). A significant correlation also occurred between the total SEI posttest score and the students' rating of their level of self-esteem at the third interview ($r = .41$, $p = 0.01$).

The means of the students' self ratings of "self-esteem generally" were 4.07 at Interview #1 and 4.13 at the time of Interview #3 (scale of 1-5). Analysis of variance produced no significant differences between these pre and posttest results. A significant increase in the means of the students' self-ratings of self-esteem in relation to IM injections at the time of Interview #1 and Interview #3 occurred (pretest mean = 3.30, posttest mean = 3.72). Analysis of variance results are presented in Table 19 and are significant at the 0.01 level (F ratio = 9.02).

TABLE 19

Summary of One-Way Analysis of Variance Comparing Self-Ratings of Self-Esteem in Relation to IM Injections on Two Occasions: Interview #1 and Interview #3

Source	Sum of Squares	df	Mean Squares	F Ratio	Prob.
S-WITHIN	35.489	45.	0.789		
A	3.924	1.	3.924	9.019	0.004*
AS-WITHIN	19.576	45.	0.435		

*significant at 0.01 level

Several strong significant relationships were noted between self-ratings of self-esteem in relation to IM injections and other variables (see Table 20). A strong positive relationship (significant at the 0.01 level) existed between self-rating of self-esteem in relation to IM injections and self-rating of confidence (r = .69), and self-rating of skill at giving an IM injection (r = .67). A strong negative relationship was present between self-rating of self-esteem (IM injections) and the time taken to prepare the Final Injection (r = -.44).

TABLE 20

Pearson Correlation Coefficients: Self-Esteem

	Self-Rating Skill Preparing	Self-Rating Skill Giving	Self-Rating Confidence in Giving	Instructor-Rating Knowledge	Preparation Time Inj. #3	Equipment & Recording Score Inj. #3	Preparation Time Final Inj.
Self-Rating of Self-Esteem in Relation to IM Injections	.48*	.67*	.69*	.43*	-.62*	.46*	-.44*

*Significant at 0.01 level

Self-Efficacy. Students were asked to rate their level of self-efficacy for seven components of the IM injection procedure on six different occasions: Interview #1, Laboratory Injection, Injection #2, Injection #3, Final Injection, and Interview #3. The means and standard deviations of self-efficacy scores for the six occasions are shown in Table 21.

TABLE 21

Means and Standard Deviations of Responses on Self-Efficacy (Form A) on Six Occasions: Interview #1, Laboratory Injection, Injection #2, Injection #3, Final Injection and Interview #3

	Mean	S.D.	Cases
Interview #1	24.91	14.52	45*
Injection #1 (Lab)	45.67	10.35	45
Injection #2	50.58	10.86	45
Injection #3	52.33	12.41	45
Final Injection	56.33	8.94	45
Interview #3	58.60	8.84	45

*Missing Cases: 2 students failed Nursing 320
1 missing response on one occasion

The level of self-efficacy increased steadily as the students progressed through the learning experience. Analysis of variance results show a significant difference of mean scores across the six occasions (F ratio = 72.39, p = 0.001) (Table 22). The box and whisker display illustrates the changes over time and the range of scores,

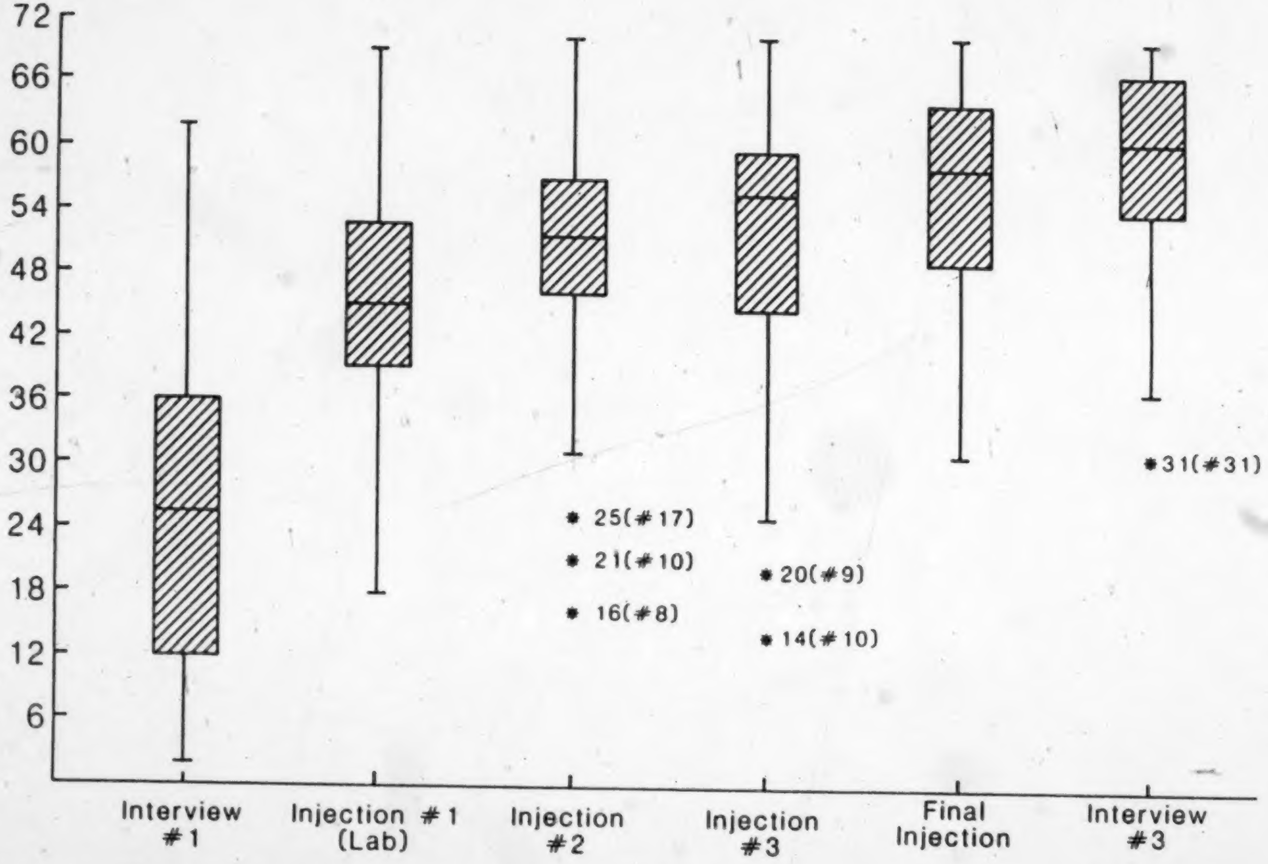
TABLE 22

Summary of One-Way Analysis of Variance Comparing Scores on Self-Efficacy (Form A) on Six Occasions: Interview #1, Laboratory Injection, Injection #2, Injection 3, Final Injection and Interview #3

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	12350.500	44.	280.693		
A	33810.293	5.	6762.059	72.388	0.001*
AS-WITHIN	20551.125	220.	93.414		

*significant at 0.01 level

and identifies the outliers who have low self-efficacy (Student #8, #10, and #17 for Injection #2; #9 and #10 for Injection #3; and #31 for Interview #3) (Display 16). Appendices 21-24 contain the frequencies and percentages of the level of self-efficacy on the four injections. Generally, self-efficacy increased on all seven of the procedure components. On Injections #2 and #3 a few students experienced lower self-efficacy in relation to "Preparing the Patient". By the Final Injection, the range of scores for four of the components ("Calculating the Dosage", "Drawing up the Medication", "Placing the Needle into the Patient", and "Injecting the Medication") was between 5 and 10. For the remaining components, "Giving without Supervision", "Preparing the Patient" and "Landmarking", the ranges were 2 to 10, 3 to 10, and 4 to



DISPLAY 16

Box and Whisker Display for
Self-Efficacy (Form A) on Six Occasions

10 respectively. In addition, fewer students had a high level of self-efficacy (rating of 10) on these last three components. The highest level of self-efficacy was in relation to "Injecting the Medication" (36.96%), while the lowest level was in relation to "Giving without Supervision" (6.52%).

As part of the assessment of self-efficacy, students were asked to describe outcome expectations regarding their first IM injection, as well as their outcome expectations about injections after having completed a minimum of five. See Appendix 25 for a comparison of outcome expectation statements. A summary of the outcome expectation statements given prior to learning about IM injections is included as Table 23. It was possible to categorize the responses into two categories: performance (74.54%) made up of positive statements (45.45%) and negative statements (29.09%); and concern about the patient and the patient's reponses (25.45%).

TABLE 23

Students' Descriptions of Outcome Expectations Prior to Learning the IM Injection Procedure

Category	Frequency	Percentage
PERFORMANCE	82	74.54
Positive Statements	50	45.45
Able to do it	25	22.73
Preparation ("I'll be prepared")	3	2.73
Learning experience	2	1.82
Qualifying Statements	20	18.18
"Hopefully, I can do it"	8	7.27
"I think I can do it"	7	6.36
"If others can, I can"	3	2.73
"Probably I can do it"	2	1.82
Negative Statements	32	29.09
Negative comments (slow, mess up)	7	6.36
Specific worries (dose, site)	7	6.36
Feelings of relief afterwards	6	5.45
Nervous	6	5.45
Physical signs (shaking, sweating)	4	3.64
Not able to do it	2	1.82

(table continues)

Category	Frequency	Percentage
CONCERNS RE: PATIENTS AND THEIR RESPONSES	28	25.45
Will cause pain	13	11.82
No pain	3	2.73
"Hopefully, no screaming"	3	2.73
Patient will be nervous	2	1.82
"Not killing the patient"	2	1.82
Patient jumps	2	1.82
Relief for patient after	2	1.82
Good feedback from patient	1	.91
Total	110	100.00

n = 48 students

The largest proportion of comments (22.73%) were positive statements about being able to do the injections. A number of statements were related to a concern that the injection would be painful for the patient (11.82%).

When evaluating the differences between expectations about giving IM injections and the actual experience of giving IM injections, 50% found it to be easier than they had expected.

> It was much easier - I enjoy doing them, they are fun.
>
> Easier, not as scary as expected.
>
> It's nothing - I can't imagine why I had to go through hypnosis to be able to do them.

> I like it better than I thought I would.

Those finding it more difficult (25%) described it this way:

> I wasn't nervous at first, but then I realized what a big deal landmarking is.
>
> There was a lot more to it than I thought.
>
> I didn't realize all about calculating the dosages and what was involved.
>
> I'm still anxious about them.

Some of the students who found the experience similar (25%) to their expectations were concerned about actually giving the needle:

> I thought it would be hard to push the needle into people and it was.
>
> I was worried about putting the needle into a patient and it was as I expected.

At the time of Interview #1 and again at Interview #3, students were asked to evaluate their level of self-efficacy in terms of being able to do most things in nursing. A stem and leaf display (Display 17) includes the distribution of scores, and the means and standard deviations. Visual inspection of the display reveals that on the posttest, the number of "8's" decreased and the range changed from 5-10 on the pretest to 3-10 on the posttest. At the time of Interview #1, four students rated themselves as having low self-efficacy in terms of nursing activities (Student #7, #22, #43, and #48) (Display 18).

By Interview #3 two students stand out as having ranked their level of self-efficacy as low (Student #31, and #36). Others such as Students #4, #11, #20, #28, #29, #35, and #48 rated themselves as low but their scores were not low enough to be outliers. Some of these low self-efficacy students from both interviews were previously identified as being low in self-esteem (Student #22, #36, and #48). Analysis of variance results showed no significant difference between the mean scores at Interview #1 and Interview #3.

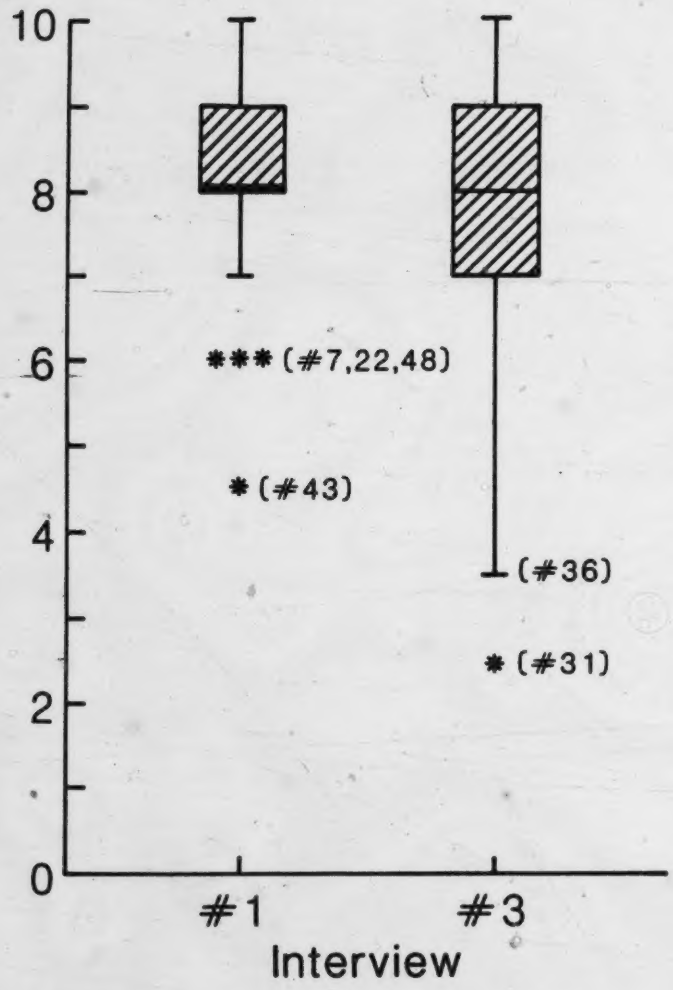
DISPLAY 17

Stem and Leaf Display for Self-Efficacy - Able To Do Things in Nursing

(Stem : tens
Leaf : units)

Pretest (Interview #1)	Posttest (Interview #3)
0 :	0 : 3
0 :	0 : 4
0 : 5	0 : 5
0 : 666	0 : 666666
0 : 777777	0 : 7777777
0 : 888888888888888888888888	0 : 88888888888888
0 : 99999999999	0 : 9999999999999
10: 000	10: 000
n = 48	n = 46*

*missing cases: 2 students failed N320



DISPLAY 18

Box and Whisker Display for
Self Efficacy - Able to Do Things in Nursing

Several correlations between being able to do things in nursing and other variables are of interest (see Table 24). The strongest relationships were with self-ratings of skill in preparing injections (r = .57), skill in giving injections (r = .33), confidence in preparing injections (r = .68), and confidence in giving injections (r = .54) (all significant at the 0.01 level).

TABLE 24

Pearson Correlation Coefficients: Self-Efficacy - Able To Do Most Things in Nursing

	Self-Rating Self-Esteem (Generally): Interview #3	Self-Rating Self-Esteem (Injections): Interview #3	Self-Rating Skill Preparing Injections	Self-Rating Skill Giving Injections	Self-Rating Confidence in Preparing Injections	Self-Rating Confidence Giving Injections	Equipment & Recording Score: Injection #
Self-Rating of Self-Efficacy: Able To Do Most Things in Nursing Interview #3	.46*	.46*	.57*	.33*	.68*	.54*	.45*

*significant at 0.01 level

In order to determine if levels of self-efficacy had an effect on performance, the top one-third of the high self-efficacy students were compared with the bottom one-third low self-efficacy students. On Injection #2, the group with high self-efficacy required less time to prepare and administer the injection, but received lower performance scores on Preparation, Administration, Equipment and Recording, and Total Score. However, none of these differences was significant. On Injection #3, the high self-efficacy group took less time to prepare the injection, but more time to administer it. They also scored slightly lower on all four performance scores. None of the differences was significant. At the Final Injection, the high self-efficacy group required more time to prepare and administer the injection. Again they received lower scores on the four performance measures, but the differences were not significant. The results of these comparisons are difficult to explain since it was anticipated that those students with high self-efficacy would also have high performance scores. One explanation is that on Injection #2 two students gave injections to children. Student #20 tried to give the injection, but experienced difficulties (the child's father became upset and requested that the instructor give the injection). The student therefore only received 49% for that injection, and since this was 14 percentage points below the next lowest score, it definitely lowered the group scores. On the Final Injection, three students gave injections to children. These students' performance scores were low and were within the bottom one-third of the class on that injection. However, on Injection #3, none of the high self-efficacy group gave injections to children. These students appear to have overestimated their level of self-efficacy, in relation to Injection #3. Another explanation may be that the assessment tool - Form A - is not actually measuring self-efficacy.

Performance. Students were given the opportunity to give one IM injection to a classmate, and to give one IM injection to a patient prior to being evaluated. They were then evaluated on Injection #2 (second injection to a patient), Injection #3, and a Final Injection, using the Intramuscular Injection Observation Sheet (IIOS) checklist.

The means of the Time (in minutes) taken to Prepare the three injections were 6.87 (Injection #2), 6.26 (Injection #3), and 5.39 (Final Injection). The time required decreased over the three injections, but the differences were not significant at the 0.05 level (F ratio = 2.4, df. = 2,60). The Time taken to Administer the injection was also recorded for the three injections (Table 25), and a significant difference was apparent (F ratio = 8.88, p = 0.001) (Table 26).

TABLE 25

Means and Standard Deviations of Time Taken (in Minutes) to Administer Three IM Injections

	Mean	S.D.	Cases
Injection #2	4.17	2.25	30*
Injection #3	4.60	3.82	30
Final Injection	2.13	1.28	30

*Missing Cases: 18 (Due to difficulty experienced by instructors in recording the time taken, e.g., more concerned with safety issues.)

TABLE 26

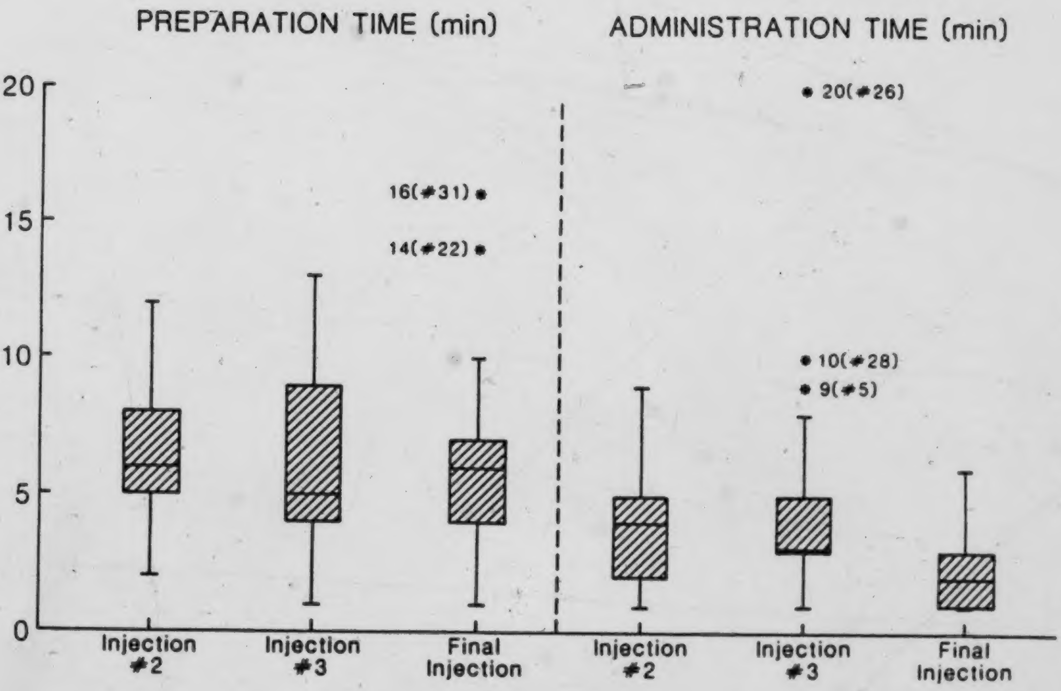
Summary of One-Way Analysis of Variance Comparing the Time Taken (in Minutes) to Administer Three IM Injections

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	276.899	29.	9.548		
A	104.067	2.	52.033	8.878	0.001*
AS-WITHIN	339.935	58.	5.861		

*significant at 0.01 level

A box and whisker display illustrates the preparation and administration times for the three injections (Display 19). For Preparation time on the Final Injection, two outliers are noted: Student #22 and Student #31. Student #22 required three attempts to draw up the medication into the syringe. For Student #31, the procedure was done in a different clinical area and she indicated that she was "nervous" about the injection. For Administration time on Injection #3 Students #5, #26 and #28 were outliers. Both Student #5 (9 minutes) and Student #26 (20 minutes) gave this injection to children and the longer times reflect the time taken to prepare the child for the injection rather than just the actual time taken to insert the needle and inject the medication.

It must also be pointed out that the clinical instructors found it very difficult to accurately measure



DISPLAY 19

Box and Whisker Display for
Preparation and Administration on Three IM Injections

the time taken by the students to prepare and administer the injections. The major responsibility of the instructors is to ensure that the student prepares and administers the injection safely, and at the same time, to provide a supportive learning environment. Often the situation is not very conducive to learning. A frequent occurrence is that the operating room will call for a patient sooner than scheduled, forcing the preoperative injection to be prepared and given in a hurry. Often the operating room staff are waiting in the room for the student to give the injection. The instructor in such a situation has other demands to consider than observing or assessing the time required for the student to prepare and administer the injection. As a result of such situations, there were 17 missing incidents for the time required to prepare injections, and 18 missing incidents for the time required to administer the injections.

The means scores obtained for the Preparation of the three injections increased with each injection (Injection #2 = 89.02, Injection #3 = 90.54, Final Injection = 93.28). A one-way analysis of variance demonstrated that the results were significant at the 0.05 level (F ratio = 3.275) (Table 27). Administration scores also showed an increase over the three injections, with the mean of Injection #2 at 83.30, the mean for Injection #3 at 87.11, and the mean for the Final Injection at 90.15.

TABLE 27

Summary of One-Way Analysis of Variance Comparing Preparation Scores (in Percent) on Three IM Injections

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	4603.000	45.	102.289		
A	428.914	2.	214.457	3.275	0.042*
AS-WITHIN	5893.000	90.	65.478		

*significant at 0.05 level

The differences between the scores was significant at the 0.05 level (F ratio = 7.72) (Table 28).

Examination of the Equipment and Recording scores revealed a different pattern. The mean for Injection #2 was 83.28%, rising to 87.22% for Injection #3, and dropping to 77.83% for the Final Injection. The differences were significant at the 0.05 level (F ratio = 4.14) (Table 29). The main explanation for the decrease in scores at the end was likely that the Final Injection occurred during the Spring Session practicum, and many of the students were assigned to hospitals or units where they had not been previously. A new environment may lead to uncertainties and difficulties, particularly in relation to equipment and how and where to record the administration of a medication. The problem was further compounded by the fact that a number of students gave the Final Injection on the first day of the clinical session, before they had time to be well oriented to the unit.

TABLE 28

Summary of One-Way Analysis of Variance Comparing Administration Scores (in Percent) on Three IM Injections

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	4520.563	45.	100.457		
A	1082.977	2.	541.488	7.724	0.001*
AS-WITHIN	6309.813	90.	70.109		

*significant at 0.01 level

TABLE 29

Summary of One-Way Analysis of Variance Comparing Equipment and Recording Scores (in Percent) on Three IM Injections

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	19485.500	45.	433.011		
A	2046.281	2.	1023.141	4.139	0.019*
AS-WITHIN	22248.313	90.	247.203		

*significant at 0.05 level

Since most of the instructors trained in the use of IIOS checklist were not providing clinical supervision of the students during Spring Session, it was necessary for the investigator to observe the Final Injection for 33 of the 46 students. While the investigator was known to the students, they had not been with her in the clinical setting before. Despite this situation, the students' anxiety level on the Final Injection was not elevated.

The means of the Total Scores (obtained by taking the means of the scores on Performance, Administration, and Equipment and Recording) increased with each injection (85.65, 88.33, and 89.83). The differences were significant at the 0.05 level (F ratio = 5.49) (Table 30).

TABLE 30

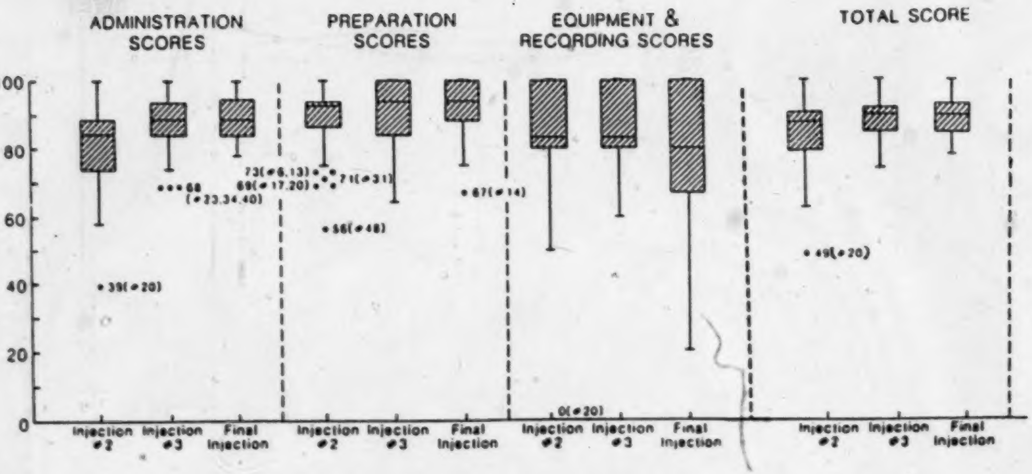
Summary of One-Way Analysis of Variance Comparing Total Score (in Percent) on Three IM Injections

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Ratio	Probability
S-WITHIN	3022.000	45.	67.156		
A	412.922	2.	206.461	5.491	0.006*
AS-WITHIN	3384.000	90.	37.600		

*significant at 0.01 level

A box and whisker display (Display 20) allows for a visual comparison of the four performance scores across the three injections. It is possible to identify the outliers in each situation. Student #20 (already mentioned as the one unable to complete the injection) is an outlier on all four of the performance scores for Injection #2. On the Preparation Score for Injection #2, the outliers were Students #6, #13, #17, #20, #31, and #48. Two students, #20 and #31, gave this injection to a child. This adds another dimension to the preparation of the injection, since the calculation of the dosage of the medication is more difficult (often involves fractions), and also requires that the dose be checked for appropriateness according to the child's body weight. The student must then accurately draw up a small amount of medication into the syringe. Students #6, #31, and #48 all expressed concerns regarding their high level of anxiety related to injections. Student #17 eventually failed Nursing 320.

On Injection #3, there were three outliers on Administration scores (Students #23, #34, and #40). For these three students this low score stands out as the only low score they received across all the performance items for all three injections. Student #23 had to give this injection in a hurry, and also had to give it into a site she had not used before. Student #34 was in the situation of giving her first injection to an adult patient. Since



DISPLAY 20

Box and Whisker Display for
Ratings of Performance on Three Occasions

her previous two injections had been with children, she assumed it was a similar situation and she approached this elderly gentleman with the routine used with children. She discovered to her dismay that he had very tough skin. The needle bounced right out and she had to give the injection again. "I was a nervous wreck by the time I was done" was her comment. With Student #40 there does not appear to have been any unusual circumstances surrounding Injection #3. In fact, the student had given an injection to this same patient earlier in the day. For some unknown reason she made numerous errors during the administration of the injection. On the Final Injection there is one outlier, Student #14 (Preparation Score). This student had consistently high scores on her other injections. In this last injection her patient was a child. The student made several mistakes in terms of selecting the correct size of needle to use and the appropriate measurement to use when drawing up small amounts. These descriptions of the outliers suggest that in this early phase of giving injections the students have difficulty transferring principles or rules to different situations.

Table 31 is a summary of the number of different IM injection sites used by the students. It is encouraging to see that 71.74% of the students used between 2 to 4 sites. Of some concern is the fact that 28.26% have only given IM injections into one site. Throughout the study students commented on the need to feel comfortable with locating other appropriate sites. All four of the students who have given IM injections using four sites gave some of those injections to children. One of the advantages of having students give injections to children is that they will likely have to try some different sites. Table 32 is a summary of the actual sites used. It is interesting to note that 71.16% of all the injections were given into the ventrogluteal site. The preference for this site reflects the fact that it is a very safe site, as well as the bias of the classroom lecturer. This causes some problems for students involved in clinical practice. Few general duty nurses have been taught how to locate and use the

TABLE 31

Number of Sites Used for IM Injections

Number of Sites Used	Frequency	Percent
1	13	28.26
2	14	30.43
3	15	32.61
4	4	8.70
Total	46*	100.00

*Missing Data: 2 students failed Nursing 320 ventrogluteal site, so if they are supervising a student they will not let the student give the injection in that site. Often they think the student is incorrectly trying to locate the dorsogluteal site (which is the one used by most nurses with adult patients). It is worth noting that 48 students gave a total of 371 IM injections during approximately 10 weeks,being in the clinical area two days per week, during the term (20 clinical days) and a three week period in May during which they were involved in clinical practice for five days per week (15 clinical days). By the end of the winter term (January to April) 46 of the 48 students had given three or more IM injections.

TABLE 32

Sites Used for IM Injections

Sites	Number of Injections	Percent
Ventrogluteal	264	71.16
Deltoid	47	12.67
Dorsogluteal	37	9.97
Vastus Lateralis	18	4.85
Rectus Femoris	5	1.35
Total	371	100.00

In this study students who had given previous injections were included. Two of these students had given previous injections to animals (mainly cows), while four had given previous IM injections to humans. A comparison was made between the three groups (no previous injections, previous injections to animals, and previous injections to humans) on each of the performance variables for all three injections.

Appendix 26 illustrates the comparison of Adminstration scores with the three groups on Injection #2. Both the Scheffé and the Newman-Kuels procedures produced significant results. The group with previous experience with animals had significantly lower scores (mean = 53.50%) than both the other groups. However, the much lower score is likely due to the low score of Student #20 who was unable to complete Injection #2. The group with previous human experience achieved the highest scores (mean = 90.50%) but was not significantly different from the group without previous experience (mean = 83.43%). In Appendix 27 the comparison of Equipment and Recording scores on Injection #2 is shown. The group with previous experience with animals has significantly lower scores (mean = 41.50) due to the fact that Student #20 was unable to complete the injection. The group with experience giving injections to humans obtained the highest mean score (86.50) but it was not significantly different from the group without previous injection experience (mean = 84.98). Appendix 28 shows the comparison of Total scores on Injection #2. Group 2 (experience with animal injections) (mean = 63.50%) was significantly different at the 0.05 level from the group with human experience (mean 91.50%) and the group with no experience (mean 85.55%). This difference is also influenced by Student #20's low score. Again, the group with experience giving injections to humans obtained the highest score but it was not significantly different from the group without injection experience.

When the Administration scores on Injection #3 were compared (Appendix 29) the Scheffé procedure did not identify any groups as being significantly different. The mean of the group with experience with animals was 76.5%, the mean of the group with no experience was 87.11%, and the mean of the group with human experience was 92.0%. The Newman-Kuels procedure identified that the group with previous experience with animals scored significantly lower than the group with previous experience with humans (significant at the 0.05 level). There was no significant difference between the group without experience and the group with previous human experience.

In Appendix 30 the effect of previous injections on the Time (in minutes) taken to administer the Final Injection is shown. The results of the Scheffé procedure indicate that the group with no previous experience (mean = 2.00 minutes) took significantly less time to give the injection than the group with previous injection experience with animals (mean = 4.50 minutes). The less conservative Newman-Kuels procedure led to the finding that the group with no previous experience was also significantly different (at the 0.05 level) from the group with previous experience with humans (mean = 3.50 minutes). This finding that the group with no previous experience gave the Final Injection in less time than the other two groups is difficult to explain, especially in view of the fact that no significant differences were noted between the groups on the other two injections.

In this study, 4 of the 48 students were left-handed. When the left and right handed students were compared the most significant differences occurred in relation to the finger dexterity pretest. The left-handed students had lower scores on this one dexterity measure (t = 3.46, df = 13.22, 2-tail probability = 0.004 [separate variance estimate]). On the Equipment and Recording scores for all three injections, the left-handed students scored 8 to 15 mean percentage points lower than the right-handed subjects. Since these scores refer mainly to disposing of equipment and recording the medication, the consistent Injection, the results are questionable given the small group of subjects. These four left-handed students had very similar scores while the right-handed group was more diverse. In addition, these left-handed students took less time to prepare and administer all three injections.

Summary of Significant Findings. With respect to age, older students tended to be less anxious about the injections. There was a significant relationship between age and measures of manual dexterity and finger dexterity. Scores on the post knowledge test were significantly higher than scores on the pretest. However, level of knowledge about injections did not affect performance of the three injections. By the time of the Final Injection, about 63% of the students were rated by the instructors as having a very good or extremely good level of knowledge. In relation to academic achievement there was a high correlation betwen the grade obtained in Nursing 320 and the overall grade point average for second year.

With manipulative dexterity several confusing results are noted. While the students scored considerably higher coordination scores than the test sample populations, six students (on the pretest) were below the cut off point set for general duty nurses, and three of these students remained below on the posttest. The top one-third of the students on the coordination tests obtained significantly higher Administration and Total scores on Injection #3. Those students with higher numbers of activities (crafts, playing musical instruments, and work-related tasks such as typing) tended to have higher Equipment and Recording

Scores on Injection #3, took longer to administer the Final Injection, have higher Administration Scores on the Final Injection, and have lower Preparation Scores on the Final Injection. When students described their own level of dexterity, 12.30% described themselves in negative terms. In relation to level of skill in preparing and administering IM injections, twice the number of students rated themselves as only "moderately skilled" at administering the injection. At the time of the Final Injection, the instructors rated 93.5% of the students as "moderately skilled" or better.

On the STAI-Trait anxiety test, the students were less anxious than the test sample. There was a significant negative relationship between trait anxiety scores and self-esteem scores. STAI-State anxiety scores increased at the second injection, and then decreased for the other injections. Form B (anxiety related to injections) scores decreased over the six occasions that the rating scale was used. The one-third of the group with the highest scores on Form B (the most anxious) took more time to administer their injections, but on two of the three occasions, achieved higher performance scores. Those students with high anxiety related to injections scored significantly lower on self-efficacy, self-ratings of skill at preparing and administering injections, and in level of confidence in preparing and administering IM injections.

While the total group scored in the "high" category of self-esteem, several students were identified as having "low" levels of self-esteem, particularly in terms of the subtest scores of personal self-esteem. There was no significant difference between total pre and posttest scores. Those students with high self-esteem tended to give Injection #3 in less time and had higher performance scores. There was a strong relationship between level of self-esteem and self-ratings of skill and confidence in giving injections.

Levels of self-efficacy increased steadily over the evaluated occasions. The highest level of self-efficacy was in relation to "injecting the medication", and the lowest level was in relation to "giving the injections without supervision". Some students rated their level of self-efficacy as low in relation to being able to do most tasks in nursing and this was related to low self-rating scores in level of skill in preparing injections, and level of confidence in both preparing and giving injections.

In relation to performance, the time taken to prepare the three injections decreased slightly but was not significant. The time taken to administer the third injection was higher than the second injection, and then decreased for the Final Injection. These changes in times were significant at 0.05 level. For both the Preparation scores and the Administration scores there was a statistically significant improvement over the three injections. The Equipment and Recording score increased at Injection #3, and dropped on the Final Injection to below the level obtained for Injection #2. This was likely due to a change in the clinical setting. Total scores increased significantly (at 0.05 level) over the three injections. On Injection #2 and #3, a number of outliers were noted, but by the Final Injection, only one was present, and that student gave the injection to a child. With respect to the number of sites used for the injections, 28.26% of the students used only one site.

The main differences between left and right-handed students were that the left-handed students scored lower on one of the dexterity pretests, obtained lower scores on "Equipment and Recording" for all three injections, and took less time to give all their injections.

The Experience of Learning to Give IM Injections

The experience of learning how to given an IM injection was described by the students themselves. The responses were analyzed, and the results were summarized in tabular form. Specific examples of student comments are included to highlight various aspects of the experience. Four major topics are discussed: previous experiences with injections; how this skill differs from other psychomotor skills in nursing; comparison of giving injections to children versus adults; and feelings and concerns about IM injections prior to learning about injections, and after completing at least four IM injections.

Previous Experience Related to Injections. Students bring to the learning situation a collection of personal experiences from having received injections in the past, as well as information obtained from observing others administer injections. When asked about personal experiences with receiving injections in the past, the 48 students in the study recorded a total of 62 comments. Of these, 42 or 67.74% were negative in nature, while 20 or 32.26% were positive. For a number of these students, their frame of reference related to injections was negative initially. This can readily be seen by comments such as the following:

> Some I guess were bad. I had pneumonia and those needles hurt very much.
>
> Ever since I was six months old and my mother took me to the doctor, I just froze up, and ever since then, there was no way I'd have the needles. It would take five nurses to hold me down. When I was thirteen, I said 'well, I'm a teenager now and I'm going to do this right'. I sat in the chair and just passed right out. So I thought there is no point in coming into nursing. Even up until last year when I was already in nursing, thinking about needles made me hyperventilate and take these fits. I couldn't take it anymore - I was afraid I would embarrass myself in front of the whole class. I went and got hypnotized. I had three sessions. I think now I'll be able to take it in stride. All the other nursing students went through the injection experience, so why can't I.

Other students commented on their perceptions of the actions or behavior of nurses.

> Sometimes some nurses have been very rough. They don't say anything, they just go and jam this needle in. Others though are really considerate. They try to assess your level of calmness, and then go ahead with the procedure.
>
> It was funny because some of the nurses knew how to give it right and it didn't hurt, and some did not. I definitely don't want to be one of those that do not do it right. I don't want to inflict pain like that on someone else.
>
> One nurse just got the needle and just jammed it right in. I was sore for about three days. Possibly I won't use that technique.
>
> I've been in the hospital a lot, and there are some nurses that you notice that they are giving you an injection, and other nurses, it feels like they are standing at the door and are asking you to turn over. You notice the different techniques.
>
> I'd have to say three-quarters of my experiences were bad. Only one nurse ever has given me a needle that wasn't bad. I liked her way and I'll try to do it her way. I just remember it so clearly because it was the only good one I ever had; all the others were quite painful.

During the previous term, all but seven of the students had the opportunity to observe injections being done in the hospital. Their comments were analyzed, and the summary is presented in Table 33. The comments fit into six categories: nurses' techniques, nurses' relationships with patients, students' thoughts and

TABLE 33

Students' Comments Regarding Observations of Patients' Receiving Injections Prior to Instruction about Injections

Category	Positive		Negative		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Nurses' techniques	7	11.29	11	17.75	18	29.04
Students' thoughts and feelings	7	11.29	11	17.75	18	29.04
Injections to infants	2	3.24	8	12.90	10	16.14
Nurses' relationships with patients	1	1.61	5	8.06	6	9.67
Intravenous injections	1	1.61	4	6.45	5	8.06
Patients' responses	2	3.24	3	4.84	5	8.06
Total	20	32.28	42	67.75	62	100.01

7 students had not observed any injections.

feelings while watching injections, injections given to infants, intravenous injections, and patients' responses. Comments about the nurses' techniques accounted for 29.04% of the responses. Negative comments such as "she barely landmarked", "she did it too fast and hard", and "she really jabbed the needle in" were noted. On the positive side, students commented that the nurse was "efficient", "confident", and "matter of fact". An equal number of responses (29.04%) centered around the students' thoughts and feelings experienced as they watched injections being given. Of these thoughts and feelings, 11.29% could be considered positive statements, while 17.75% were negative in nature. For-example, positive statements included the following: "it looked easy", "it was interesting", and "I could do it". Negative comments described the injection as "looked painful", and "vicious".

Of the 16.14% of the comment related to infants, most of the comments were negative (12.90%). Several students were upset by the crying or screaming of the infants during and after the injection. Others were concerned about the actual giving of the injection to small babies:

> Yes, I've seen them done on babies. It is a little scary, in a way, because it goes so deeply right into the flesh, and you go 'oh my God'. Also when they are doing them on babies like that, the babies scream. It even increases the bad feeling you have.
>
> I saw a baby being injected with Vitamin K. It just seemed like murder, the nurse just stabbed him and let him go. It seemed almost aggressive. I think the ones that I saw with adults seemed gentler, more kind.

Five out of the six responses regarding the nurses' relationships with patient were negative (8.06%). Students commented that the nurse "should speak to the patient", "was not friendly", "did not prepare the patient for the injection", "did not check back to evaluate the effects of the medication", and seemed to "almost be attacking the patient". The one positive comment was that one nurse was observed using several different approaches with individual patients.

Four of the five comments about intravenous injections (IV's) were negative (6.45%). Students described IV's as "horrible", "painful", and noted that often it took "several attempts" to get the needle in place. In conversation with the students during the interviews students reported more concern with giving and receiving IV's than intramuscular injections. Several described situations where the patient really suffered while attempts were being made to insert the needle into a vein.

The observed patient responses to the injections were mainly rated as negative (4.85%). In two situations the students were distressed because they felt that the patients did not want the injections but were forced to have them against their will.

In summary, students observations of injections were decidedly negative. Their interpretations of the nurses' techniques may reflect their own underlying concerns about giving injections. Of particular concern are the comments about the observed nurses' interactions with patients while giving injections.

How IM Injections Differ from Other Nursing Skills. When asked if the skill of giving intramuscular injections was any different in comparison with other nursing skills, only nine students thought it was not different. The remaining students (39) suggested that IM injections are different. The responses are presented in Table 34.

Students recognize that patients respond very differently to injections than they do to other nursing procedures (17.14% of the responses related to patient responses). One student expressed it this way: "Well, a lot of people are scared of needles, and are really nervous. They need more explanation and communication about having an injection". From the students' perspective, giving IM injections involves more serious consequences if done incorrectly (15.23%), causes more pain to the patient (13.33%), involves the giving of medications and the calculation of dosages (9.52%), is more invasive (7.61%), is more anxiety-producing (6.66%), and requires more coordination and manipulation (5.71%). Several of the students describe the differences this way:

> Compared to the other nursing skills that I've already learned, it has to do with a life, so, it's more than just me involved - maybe I could say it is more of a risk. Compared to other skills I've learned I would say it is definitely one of the harder, more important ones.
>
> I think it will take a lot more manual dexterity than the other things we have done. They are more

gross motor. Some of the patients will be anxious about it, which is something else you have to deal with.

It is okay if you know what you are doing. There is more chance of causing a life threatening event - e.g., calculating the dosage incorrectly, hitting a nerve.

TABLE 34

How IM Injections are Different from Other Nursing Skills

Description of Differences	Frequency	Percentage
Patients' responses	18	17.14
More serious consequences	16	15.23
Causes more pain	14	13.33
Involves medication, dosages	10	9.52
No difference	9	8.57
Invasive (putting something into patient)	8	7.61
More anxiety-producing	7	6.66
Requires more coordination, manipulation	6	5.71
More responsibility	6	5.71
More knowledge (sites, needles, etc)	4	3.80
Must be more careful and cautious	2	1.90
Harder	1	.09
More scary	1	.09
More interesting	1	.09
Looking forward to them	1	.09
Easier	1	.09
Total	105	100.00

Feelings and Concerns Related to IM Injections. Students were asked at the time of the first interview (prior to learning about injections) and at the third interview (after giving a minimum of four IM injections) to describe any feelings and concerns about IM injections. A comparison of the responses obtained on the two occasions is contained in Table 35. Responses were grouped under the headings of preparation, administration, negative, and positive. In preparing the injection, a major concern during both interviews was calculating the dosage (Interview #1 [6.75%], Interview #3 [8.11%]).

By the time of the third interview some students expressed concern with drawing up the medication (4.05%) and commented that they "checked the dose 500 times" to be sure that it was correct (2.70%). At both interviews the largest number of concerns involved the administration of the injections (Interview #1 [38.5%], and Interview #3 [50%]).

Prior to learning about injections, the students expressed concern that the injection would cause pain (11.48%), and that serious consequences such as "hitting nerves", "the needle breaking", "aspirating blood", "air bubbles", and "bruising" could occur (6.08%). Another 6.08% of the responses dealt with fears of putting the needle into another person. The students initially questioned how well they would be able to do the injections (10.13%).

TABLE 35

Feelings and Concerns About IM Injections Prior to Learning About Injections and After the Final Injection

Feelings and Concerns About IM Injections Prior to Learning About Injections			Feelings and Concerns About IM Injections After Final Injection		
Category	Frequency	Percentage	Category	Frequency	Percentage
Preparation	19	12.84	Preparation	16	21.62
Calculating dosage	10	6.75	Calculating dosage	6	8.11
?Right drug	5	3.37	Drawing up medication	3	4.05
Wrong dosage	4	2.70	New drugs	2	2.70
			Check dose many times	2	2.70
			Breaking open ampule	1	1.35
			?Right drug	1	1.35
			Contaminating the plunger	1	1.35
Administration	57	38.51	Administration	37	50.00
Causing pain	17	11.48	Landmarking	18	24.32
How well it will go	15	10.13	?Right spot	4	5.41
Putting needlz in	9	6.08	Having someone check correctness of site	4	5.41
Serious consequences	9	6.08	Aspirating	3	4.05
Response of patient	4	2.70	New sites	2	2.70
Giving it to children	2	1.35	Remembering all the steps	2	2.70
Method of giving it	1	.67	Getting needle in fast enough	1	1.35
			Preparing child	1	1.35
			Making adjustments for small hands	1	1.35
			When to use shorter needle	1	1.35
Negative Responses	37	25.00	Negative Responses	21	28.38
Anxious	21	14.18	Each instructor had different ways to landmark	2	2.70
Dislikes needles	3	2.02	More practice on each site	2	2.70
Scary	2	1.35	Still nervous	2	2.70
"Supervision makes me nervous"	2	1.35	Afraid of injuring patient (wrong spot)	1	1.35
Worried re: practicing on each of them	2	1.35	Side effects of drug	1	1.35
Giving without supervision	1	.67	Injury to patient (wrong spot)	1	1.35
Contradiction of "help vs. hurt"	1	.67	Afraid of hitting	1	1.35
Involves sharp objects	1	.67			
Nervous about getting an IM (lab)	1	.67			

(table continues)

Category	Frequency	Percentage	Category	Frequency	Percentage
Not the first to do it	1	.67	Need more practice before 3rd year	1	1.35
"Get nauseous watching"	1	.67	Anxious with new site	1	1.35
Fainting	1	.67	Giving to child	1	1.35
			Giving to male patient	1	1.35
			Giving to obese patient	1	1.35
			Giving to a tiny patient	1	1.35
			Worried if needles get any longer	1	1.35
			"So nervous putting needle in"	1	1.35
			"Looks like needle goes in so far"	1	1.35
			"Everyone is so different (site and location of correct site)	1	1.35
			Nervous with someone watching	1	1.35
Positive Responses	35	23.65	Positive Responses	0	0
Looking forward to it	8	5.40			
Wish we had done them sooner	5	3.37			
"It's really nursing"	4	2.70			
"Others say it is early"	4	2.70			
Excited	3	2.02			
Want to practice	3	2.02			
"Not too difficult"	2	1.35			
Want to see demonstration	1	.67			
Knowledge	1	.67			
Feedback wanted	1	.67			
Enjoy perfecting the skill	1	.67			
Good to have the skill	1	.67			
Want to be good at it before giving to patient	1	.67			
Total	148	100.00		74	100.00

By the time of the third interview the most common and apparently major concern focused on landmarking or finding the correct place to put the needle (29.73%). This apprehension about the correct site is also noted in the concerns related to wanting someone to check (and thereby take some of the responsibility) that the student had located the right place for the injection (5.40%).

Initially, 24.32% of the students' comments were classified as negative, whereas after giving some injections this value increased to 28.38%. It appears that more knowledge and experience with injections may lead to an increased number and diversity of concerns. Before giving injections students expressed considerable concern about being anxious (14.18%). After giving at least four IM injections, anxiety statements decreased to 2.70% of the total responses. This finding is consistent with the gradual decrease in anxiety that was noted across all the injections both on the STAI-State and Form B (anxiety related to injections). At the end of the study, the students' concerns had shifted to uncertainty regarding new situations, such as "new sites", "male patients", "obese patients", "tiny patients", and "children". As one student put it "everyone is so different in terms of size, shape, site location - you flip open the pyjamas and surprise!"

Prior to giving injections, these students expressed a number of positive feelings (23.65%). A few were looking forward to giving injections (5.40%). Others were "relieved to finally be doing injections" and wished that they could have done them sooner in the program (3.37%). The importance of injections in nursing was portrayed by responses like "its really nursing!" (2.70%).

At the time of the last interview, no positive feelings were stated. Since many of the positive comments earlier were anticipatory in nature, once some injections were given, the statements were no longer relevant. For these students the focus of concern had become landmarking and dealing with different injection situations. Somewhat related to the area of concerns and feelings, was the question of what was the easiest part of the IM procedure, and what was the most difficult. This question was asked at the third interview. A summary of the comments can be found in Table 36 and Table 37.

TABLE 36

Easiest Part of the IM Procedure

Category	Frequency	Percantage
Drawing up the medication	19	38
Putting the needle into patient	11	22
Injecting the medication	8	16
Calculating the dosage	5	10
Talking to patient during the injection	2	4
Pulling needle out	2	4
Finding the site (landmarking)	2	4
Knowing action of medication	1	2
Total	50	100

TABLE 37

Most Difficult Part of IM Procedure

Category	Frequency	Percentage
Finding the sites (landmarking)	16	29.63
Putting the needle into patient	9	16.67
Drawing up the medication	8	14.81
Control of needle while aspirating	6	11.11
Calculating the dosage	5	9.26
Getting the steps in order	3	5.56
Talking to patient during the injection	3	5.56
Contamination of equipment	2	3.70
Breaking open an ampule	1	1.85
? Right medication	1	1.85
Total	54	100.00

An examination of Table 36 and Table 37 leads to the conclusion that the experience of learning to give IM injections is an individual one. What is difficult for one student is easy for another. While 38% of the responses indicate that students find drawing up the medication to be the easiest part of the procedure, 14.81% of the responses indicate for others it is the most difficult part of the procedure. Again, for the category putting the needle into the patient, 22% of the responses designated that this was the easiest part, while 16.67% of the responses indicated the reverse. Calculating the dosage was comparable; 10% of the responses cited this as the easiest part whereas 9.26% of the responses stated this as the most difficult part. Talking to the patient is also similar; 5.56% of the responses described this activity as the most difficult part of the procedure, while 4% of the responses described it as the easiest part. On the other hand, landmarking was not comparable; 29.63% of the responses speak to the difficulties of locating the proper sites, while only 4% of the responses indicate that this is the easiest part of IM injections. Some of the responses indicate that students continue to have difficulties with keeping control of the syringe and needle during aspiration (11.11%). The identification of parts of the procedure that are most difficult for individual students is important, in that specific remedial work can be done to deal with the specific problems. For instance, the strategies used to help a student become more proficient at drawing up medication into the syringe are quite different from what could be done to assist a student to feel more confident giving the injection to the patient.

Comparison of Giving IM Injections to Adults and Children. During the initial part of the study, three of the eight clinical groups of students were assigned to pediatric areas. Although nursing faculty members believe that giving injections to children is more difficult, due to a lack of concrete evidence to support the feeling, it was decided to include all of the 48 subjects in the study, regardless of whether any of the three evaluated injections were done with children.

At the time of the third interview all students were asked to describe the differences between giving IM injections to children and adults. Although 30 students had given IM injections to children, 16 had not. The descriptions of anticipated differences, and the description of actual differences experienced are contained in Table 38. The responses were divided into five categories, and included preparation of medications, preparation of the child, response of the child, giving the medication, and students' feelings. The 16 students who had not given any injections to children responded with 73 comments; the 30 students who had given injections to children volunteered 135 responses.

The preparation of medication category received a similar number of responses from both groups of students (Have not given [17.81%], Have given [16.30%]). For the group who did not give any injections to children, there was a slightly higher percentage of responses related to preparation of the child (15.07%) compared with 12.59% from those students who have given injections to children. The

TABLE 38

Anticipated Differences Between Giving IM Injections to Children Versus Adults As Described by Students Who Have or Have Not Given Injections to Children

Students' Descriptions of the Anticipated Differences Between Giving IM Injections to Children Versus Adults: None given to Children			Students' Descriptions of the Anticipated Differences Between Giving IM Injections to Children Versus Adults: Have Given to Children		
Category	Frequency	Percentage	Category	Frequency	Percentage
Preparation of Medication	13	17.81	Preparation of Medication	22	16.30
Calculating dosage	8	10.96	Calculating dosage	17	12.59
Different sizes of needles	5	6.85	Different sizes of needles	5	3.70
Preparation of Child	11	15.07	Preparation of Child	17	12.59
More preparation	5	6.85	More preparation	6	4.44
More explanation	3	4.11	More explanation	8	5.93
Psychological preparation	2	2.74	Psychological preparation	3	2.22
More teaching	1	1.37	-		
Response of Child	15	20.55	Response of Child	39	28.89
May move	5	6.85	May move	17	12.59
Do not understand reason for needle	2	2.74	Do not understand reason for needle	4	2.96
See needle as punishment	2	2.74	-		
Emotional response			Emotional response		
Nervous	1	1.37	Screaming	5	3.70
Terrified	1	1.37	More scared	4	2.96

Category	Frequency	Percentage	Category	Frequency	Percentage
			Crying	2	1.48
			Very upset	1	.74
Hate nurse afterwards	1	1.37	-		
More aware of what nurse is doing	2	2.74	-		
Child's attitudes	1	1.37	-		
-			Know it will hurt	2	1.48
-			Realize have to have needle	2	1.48
-			Are trusting	1	.74
-			Really listen to nurse	1	.74
Giving the Medication	19	26.03	Giving the Medication	42	31.11
Sites are smaller	9	12.33	Sites are smaller	7	5.19
Sites are different	2	2.74	Sites are different	5	2.70
Need assistance to restrain child	2	2.74	Need assistance to restrain child	8	5.93
Play therapy necessary	2	2.74	Play therapy necessary	4	2.96
Be prepared for child to move	1	1.37	Be prepared for child to move	1	.74
Tricky	1	1.37	-		
Have to be efficient	1	1.37	-		
Takes more time	1	1.37	Takes more time	3	2.22
-			Have to be quick giving injection	6	4.44
-			Make child comfortable following injection	6	4.44
-			Monitor child's response to medication	1	.74

(table continues)

Category	Frequency	Percentage	Category	Frequency	Percentage
-			Sites are easy to find	1	.74
Students' Feelings	15	20.55	Students' Feelings	15	11.11
More anxiety	4	5.48	More anxiety	1	.74
Afraid of hurting child	3	4.11	Afraid of hurting child	2	1.48
Restraining would increase anxiety	3	4.11	-		
Depends on age of child	2	2.74	Depends on age (babies easy)	3	2.22
Everything is different	1	1.37	-		
Concerned about consequences	1	1.37	Concerned about consequences	2	1.48
Harder to do - size of child	1	1.37	Harder to do - kids are sweet	1	.74
-			Need to be more self-confident	3	2.22
-			Deceive the child	1	.74
-			Afraid child will hate nurse	1	.74
-			Child does not know if doing it right	1	.74
	73*	100.00		135*	100.00

*From 16 students who have not given an IM injection to a child.

Missing Data: 2 students failed Nursing 320.

*From 30 students who have given an IM injection to a child.

Missing Data: 2 students failed Nursing 320.

the number of comments related to the response of the child increased with the experience of giving injections to children (Have not given [20.55%], Have given [28.89%]). In addition, the responses related to giving the medication also increased (Have not given [26.03%], Have given [31.11%]). For these two categories it appears that the actual experience of giving the injections leads to an increased number and specificity of responses. For example, having given an injection to a child leads to increased understanding of the need to restrain the child during the injection.

The last category, that of students' feelings, showed a considerable drop (Have not given [20.55%], Have given [11.11%]). In this case, for students who have not given any injections to children, they anticipated a lot of feelings about how the procedure would be different. Once students had given injections to children, anxiety decreased, as did fear of hurting the child. However, these students expressed concerns such as "having to deceive the child" and being "afraid that the child will hate me". These concerns are supported by the work of Field (1981):

> When I give an injection to a child, I risk the loss of his love... He trusts me to be caring, to protect him and I betray that trust. I am forced by the child's experience to see my action as one that gives him pain. (p. 295)

Students described their reactions to giving their first IM injection to an adult patient in mainly positive ways (92.31%) (see Table 39). A number of the students made comments expressing the belief that giving injections to adults was easier than giving them to children (30.77%).

TABLE 39

Students' Reactions to Giving First IM Injection to an Adult

Category	Frequency	Percentage
Positive Responses	24	92.31
Easier to give injections to adults	8	30.77
Can focus on task and self rather than on the patient	6	23.08
After adults, easier to give injections to children	3	11.54
Adults give support and positive reinforcement	3	11.54
More prepared for adults (text, lab)	2	7.69
Student is not so nervous	1	3.85
Can ask an adult for feedback	1	3.85
Negative Responses	2	7.69
Adults watch	1	3.85
Know if injection is being done correctly	1	3.85
Total	26	100.00

With adults, the student can focus on the task and on herself (23.08%). This is important, particularly at the time the student is learning the new skill. At that point in time, the student is only able to concentrate on the task, and is unable to pay much attention to the patient as a person. For some students, the only way to get through the first few injections is to focus only on the portion of tissue where the needle will go in, rather than the patient as a whole person. Other students mentioned that adult patients can give students support and positive reinforcement (11.54% of the responses). Only 7.69% of the comments about adults were negative. These comments were of some concern to the student since it was noted that "adults watch", and that they "know if an injection is being done correctly". One of the positive statements regarding giving injections to children was that "children don't know it if you are doing the injection right". For a few students that lowered their anxiety.

For those students who gave their first injection to a child, the majority of responses were negative (65.85%) (Table 40). The main concerns centered around it being more difficult to give injections to children (14.63%), "being more anxious" (14.63%), and "feeling badly (cruel)" about the injection (14.63%). There were some positive comments (34.15%). A few students thought that since giving the injection to a child is harder, it is better to do it first

TABLE 40

Students' Reactions to Giving First IM Injection to a Child

Category	Frequency	Percentage
Negative Responses	27	65.85
More difficult to give injections to children	6	14.63
More anxious	6	14.63
Feel badly (cruel)	6	14.63
Crying child is upsetting	3	7.32
Scary	2	4.88
Difficult to prepare child and self	2	4.88
More hesitant	1	2.44
More self-conscious	1	2.44
Positive Responses	14	34.15
Child is harder so do it first	4	9.76
Child first makes it easier to do injections with adults	3	7.32
Size of child - infants are easier	3	7.32
Can legitimately request more assistance from instructor	2	4.88
Explanation to child helps the student review all the steps	1	2.44
Cuddling the child afterwards helps the student feel better	1	2.44
Total	41	100.00

(9.76%). The age of the child is an important factor - most students found that babies were easier than older children (7.32%). Two comments indicated that the students felt that with children more assistance could legitimately be sought from the instructor (4.88%).

Students' descriptions of differences in giving IM injections to adults rather than children are summarized in Table 41. Responses were organized into four categories:

TABLE 41

Students' Descriptions of the Differences Between Giving IM Injections to Adults Versus Children

Category	Frequency	Percentage
Response of the Adult	29	47.54
Can control their emotions	12	19.67
Stay still and cooperate	10	16.39
Usually want the injection	3	4.92
Ask more questions	2	3.28
Take it for granted	1	1.64
Appreciate the injection afterwards	1	1.64
Giving the Injection	16	26.23
Easier to help adult cope with the injection	6	9.84
Sites are larger	4	6.56
Landmarking is easier	3	4.92

(table continues)

Category	Frequency	Percentage
Sites harder to find	1	1.64
Takes less time	1	1.64
Can assess reaction beforehand	1	1.64
Preparation of Adult	15	24.59
Can understand reason for the injection	9	14.75
Explanation is easier	6	9.84
Preparation of Medication	1	1.64
Dosage not so critical	1	1.64
Total	61	100.00

response of the adult, giving the injection, preparation of the adult, and preparation of medication. Almost half of all the comments made were related to the response of the adult to the injection (47.54%). Adult patients can usually control their emotions better than children can (19.67%). In addition, adults stay still and cooperate (16.39%). In the category of giving the injection, students reported that it was "easier to help an adult cope with the injection" (9.84%). The sites are larger (6.56%), and landmarking is easier (4.92%). Preparation of the adult is a major category (24.59%) and responses refer to the fact it is easier to explain things to adults (9.84%), and that they tend to understand the reasons for injections (14.75%). Preparation of the medication category contained only one response (1.64%).

When students who had given injections to children were compared with students who had given the corresponding injection to an adult, significant differences occurred only on the third injection (Table 42). The group giving their injection to a child took longer to prepare and to administer this injection (t = -2.27, df = 36; t = -2.22, df = 38, significant at the 0.05 level [pooled variance estimate]). This is to be expected since the calculation of the pediatric dose is often difficult to determine, and it takes more time to get the child and any helpers organized for the injection. Interestingly enough, the group giving the injection to children scored higher than the adult group on Preparation, Administration, Equipment and Recording, and Total Scores, but the differences were not statistically significant.

TABLE 42

t-test Results of Giving IM Injection #3 to an Adult (Group 1) - Child (Group 2)

Injection #3	Number of Cases		Mean	t Value**	Degrees** of Freedom	2-tail** Probability
Time (in min) for preparing injection	Group1	33***	5.64	-2.27	36	0.029*
	Group2	5	8.80			
Time (in min) for administering the injection	Group1	35***	3.74	-2.22	38	0.033*
	Group2	5	7.20			
Preparation Score (in percent)	Group1	43	89.91	-0.83	46	0.41
	Group2	5	93.60			
Administration Score (in percent)	Group1	43	86.58	-1.35	46	0.19
	Group2	5	91.40			
Equipment & Recording Score (in percent)	Group1	43	87.33	-0.11	46	0.91
	Group2	5	88.00			
Total Score (in percent)	Group1	43	87.91	-1.37	46	0.18
	Group2	5	91.60			

*Indicates significance at 0.05 level
**Indicates pooled variance estimates
***Indicates missing cases (10 and 8) due to difficulty experienced by instructors in collecting the data

Phases in the Learning of Intramuscular Injections

After having given at least three IM injections to patients the students were asked to describe the beginning, middle, and late phases of the learning process. The students descriptions of each phase were grouped and classified under five main headings: technical, feelings, focus of the procedure, cognitive aspects, and time. The results are summarized in Tables 43, 44, and 45.

TABLE 43

Students' Descriptions of the Beginning Phase of Learning IM Injections

Category	Frequency	Percentage	Total
FEELINGS	65	29.41	65
Anxiety	38	17.19	
Increased anxiety	38	8.14	
Shaky	12	5.43	
Sweating	2	.90	
Apprehensive	1	.45	
Tittery	1	.45	
Scary	1	.45	
Nerve wracking	1	.45	
Panicky	1	.45	
Flustered	1	.45	
Uncertainty	10	4.52	
Hesitant	5	2.26	
Unsure	5	2.26	

(table continues)

Category	Frequency	Percentage	Total
Specific Worries	9	4.07	
Putting needle in	4	1.81	
Causing pain	2	.90	
Getting it done	1	.45	
General concerns	1	.45	
Instructor watching	1	.45	
Positive Feelings	4	1.81	
No big deal	1	.45	
More relaxed than expected	1	.45	
Less anxious than expected	1	.45	
Confident	1	.45	
Negative Feelings	4	1.81	
Not Too Confident	2	.90	
Incompetent	1	.45	
Major Event	1	.45	
TIME	48	21.72	48
Slow	42	19.00	
Fairly Fast	2	.90	
Moderate Speed	2	.90	
Fast at Injecting Medication	1	.45	
Quick at Preparing	1	.45	

(table continues)

Category	Frequency	Percentage	Total
FOCUS OF THE PROCEDURE	40	18.10	40
On the Task	29	13.12	
Task oriented	15	6.79	
Lack of communication with patient	9	4.07	
Inadequate preparation of the patient	5	2.26	
On the Patient	8	3.62	
Communication	6	2.71	
Reaction of patient	2	.90	
On Self	3	1.36	
On self	2	.90	
On improving	1	.45	
COGNITIVE ASPECTS	35	15.84	35
Memory	10	4.52	
Always forgetting something	6	2.71	
Trying to remember the whole procedure	3	1.36	
Problems remembering details	1	.45	

(table continues)

Category	Frequency	Percentage	Total
Thinking	7	3.17	
Concentrating	6	2.71	
Thinking a lot	1	.45	
Problems	7	3.17	
Details	2	.90	
Frequent checking	2	.90	
Procedure is all new	1	.45	
What to expect	1	.45	
Preparation - lots to think about	1	.45	
Steps	6	2.71	
Step by step	4	1.81	
Lots of steps	1	.45	
Concentrate on steps	1	.45	
Techniques	5	2.26	
Logically figure out next step	2	.90	
Recite the 40 steps	1	.45	
Think ahead	1	.45	
Memorize the steps	1	.45	

(table continues)

Category	Frequency	Percentage	Total
TECHNICAL	33	14.93	33
Get Everything Right	10	4.52	
Dosage	4	1.81	
Procedure	2	.90	
Sites	2	.90	
Equipment	1	.45	
Drug	1	.45	
Lack of Control	6	2.71	
Clumsy	1	.45	
Not accurate	1	.45	
All thumbs	1	.45	
Decreased accuracy and speed (due to shakiness)	1	.45	
Stumbled several times	1	.45	
Poor control	1	.45	
Concerns with Specific Techniques	6	2.71	
Landmarking	2	.90	
Mechanics of procedure	1	.45	
Aspirating	1	.45	
Getting rid of bubbles	1	.45	
Opening ampules	1	.45	

(table continues)

Category	Frequency	Percentage	Total
Supervision	6	2.71	
Have instructor check everything	4	1.81	
Only needed for support	1	.45	
Helpful	1	.45	
Errors	5	2.26	
Mistakes	3	1.36	
Contaminating needle	1	.45	
Letting go of syringe	1	.45	
Total	221	100.00	221

In this beginning phase, the majority of comments related to feelings (29.41%), and most described feelings of anxiety (17.19%), uncertainty (4.52%), and worries over specific parts of the procedure (4.07%). Comments about time accounted for 21.72%, and most were related to slowness in preparing and giving injections (19.00%). Of the comments describing the focus of the procedure (18.10%), most cited the focus as being on the task (13.12%) rather than on the patient (3.62%). The cognitive aspect (15.84%) included memory (4.52%), problems (3.17%), and thinking (3.17%). The technical comments (14.93%) focused on doing everything right (4.52%), and lack of control (2.71%).

The summary of the description of the middle phase is contained in Table 44.

TABLE 44

Students' Descriptions of the Middle Phase of Learning IM Injections

Category	Frequency	Percentage	Total
TECHNICAL	60	28.44	60
Improvements	33	15.64	
Landmarking	7	3.32	
Drawing up is okay	3	1.42	
Decreased amount of checking	2	.95	
Easier	2	.95	
Dosages are okay	2	.95	
Giving is okay	2	.95	
Everything flows	2	.95	
Getting better	2	.95	
More coordinated	2	.95	
More organized	2	.95	
More proficient	1	.47	
Skill is increasing	1	.47	
More steady	1	.47	
More accurate	1	.47	
Smooth	1	.47	
No contamination of needle	1	.47	

(table continues)

Category	Frequency	Percentage	Total
Put it together	1	.47	
Concerns with Specific Parts of Procedure	15	7.11	
Landmarking	7	3.32	
Need more practice	2	.95	
Mixing medications	1	.47	
Drawing up medications	1	.47	
Needle size	1	.47	
Checking chart	1	.47	
Being steady	1	.47	
Spreading the skin	1	.47	
Supervision	10	4.74	
Only need for landmarking	3	1.42	
Reassurance/approval only	2	.95	
Still like someone there	2	.95	
Feedback is helpful	1	.47	
Help with charting	1	.47	
Can prepare on own	1	.47	
Errors	2	.95	
Mistakes	1	.47	
No mistakes	1	.47	

(table continues)

Category	Frequency	Percentage	Total
FEELINGS	51	24.17	51
Anxiety	22	10.43	
Decreased anxiety	7	3.32	
Nervous	6	2.84	
Still nervous	3	1.42	
Not too nervous	3	1.42	
Shaky	6	2.84	
Scary	2	.95	
No butterflies in stomach	1	.47	
Increased Confidence	18	8.53	
Generally	7	3.32	
Can do the procedure	6	2.84	
Calculation	2	.95	
Giving injection	1	.47	
Preparing injection	1	.47	
Landmarking	1	.47	
Positive Feelings	11	5.21	
No big deal	2	.95	
No problems	2	.95	
Doing it better	2	.95	
Sure of self	1	.47	

(table continues)

Category	Frequency	Percentage	Total
Increased self-esteem	1	.47	
More in control	1	.47	
Easier	1	.47	
Okay	1	.47	
TIME	43	20.38	43
Speed is increasing	38	18.01	
Drawing up still takes time	2	.95	
Slower at injecting medication	2	.95	
No change	1	.47	
FOCUS OF THE PROCEDURE	38	18.01	38
On the Patient	36	17.06	
Communication	18	8.53	
Increased communication	7	3.32	
Communication while giving injection	6	2.84	
Communication before & after injection	3	1.42	
Trouble talking to patient	1	.47	
Easier to talk to patient	1	.47	

(table continues)

Category	Frequency	Percentage	Total
Relating to the Patient	18	8.53	
Focusing on the patient	5	2.37	
Increased explanation	4	1.90	
Comforting the patient	3	1.42	
Relaxation	2	.95	
Reassurance	1	.47	
Pain relief	1	.47	
Increased preparation of patient	1	.47	
Reaction to patient	1	.47	
On the Task	2	.95	
On the task	1	.47	
Not as task oriented	1	.47	
On Self	0	0.00	
COGNITIVE ASPECT	19	9.00	19
Thinking	5	2.37	
Planning ahead	2	.95	
Think it through	2	.95	
Lots to think about	1	.47	
Metacognitive	5	2.37	

(table continues)

Category	Frequency	Percentage	Total
Memory	4	1.90	
Remember everything	3	1.42	
Forget to aspirate	1	.47	
Techniques	3	1.42	
Review checklist	1	.47	
No need to review 3 times	1	.47	
Work on things missed previously	1	.47	
Integration of the procedure	2	.95	
Total	211	100.00	211

In the middle phase, the majority of comments relate to the technical category (28.44%). The focus of the comments is on improvement (15.64%), concerns about specific parts of the procedure (7.11%), and supervision (4.74%). In this phase, feelings account for 24.17% of the comments, with anxiety (10.43%) and increased confidence (8.53%) being the main ideas. Comments about time made up 20.36% of the comments, with most indicating that it took less time to prepare and administer the injections (18.01%). Comments related to the focus of the procedure (18.01%) indicated a marked shift to the focus now being on the patient (17.06%) rather than on the task (0.95%). The number of comments pertaining to the cognitive aspect dropped to 9.00%.

The summary of the late phase is found in Table 45.

TABLE 45

Students' Descriptions of the Late Phase of Learning IM Injections

Category	Frequency	Percentage	Total
TECHNICAL	63	38.89	63
Can find all sites on all patients	26	16.05	
Increased skill level	10	6.17	
Procedure flows smoothly	8	4.94	
Decreased supervision	7	4.32	
Use of appropriate equipment	5	3.09	
Drawing up the medication	3	1.85	
Goal - to give a painless injection	3	1.85	
Remember to check identification	1	.62	
FEELINGS	29	17.90	29
More confident	9	5.56	
Put injection procedure into perspective	7	4.32	
Decreased anxiety	6	3.70	

(table continues)

Category	Frequency	Percentage	Total
More comfortable	3	1.85	
Some concerns	3	1.85	
Independent	1	.62	
FOCUS OF THE PROCEDURE	27	16.67	27
Focus on the patient	27	16.67	
Increased communication	16	9.88	
Relaxation	3	1.85	
Comfort	2	1.23	
Focus on whole patient	2	1.23	
Coping measures	1	.62	
Individual differences	1	.62	
Pain relief	1	.62	
No focus on patient's feelings	1	.62	
Focus on task	0	0.00	
Focus on self	0	0.00	
COGNITIVE ASPECT	25	15.43	25
Remember everything	9	5.56	
Metacognitive	7	4.32	
"Knowing that I can do the procedure"	6	3.70	

(table continues)

Category	Frequency	Percentage	Total
Techniques	2	1.23	
Verbalization	1	.62	
Decreased concentration	1	.62	
Could teach someone	1	.62	
TIME	18	11.11	18
Faster	18	11.11	
Total	162	100.00	162

The late phase is characterized by an increase in the number of comments classified as technical to 38.89%. The comments expressed the ability to locate all IM injection sites on all types of patients (eg. thin, obese, children) (16.05%), and increasing level of skill (6.17%). The number of comments about feelings remains high (17.90%) but all but 1.85% of the comments are positive ones. Comments related to the focus of the procedure are slightly decreased to 16.67% but reflect a total focus on the patient. The number of comments related to the cognitive aspect increased to 15.43%. Comments about time decreased to 11.11%, and all indicated that the injection could be prepared and given faster than in previous phases.

The forty-eight students in the study produced 221 responses regarding the beginning phase, 211 responses for the middle phase, and 162 responses for the late phase.

One explanation for the decreasing number of responses may be that since fewer students had experienced the late phase, they were not as able to generate comments. For instance, 6.25% of the students indicated that they were currently at the end of the beginning phase, while another 4.17% placed themselves on the border between the beginning and the middle phases. The majority of the students (64.58%) placed themselves in the middle phase. An additional 8.33% put themselves on the border between the middle and the late phases and 10.42% put themselves in the late phase. One student (2.08%) placed herself in the middle phase for giving the IM injection and in the late phase for preparing the injection. Two students (4.17%) did not respond to the question.

An examination of the five categories across the three phases is interesting. The number of comments related to the technical category increased steadily through the phases (14.93%, 28.44%, and 38.39%). As students became more familiar with the parts of the procedure, they seemed to be able to generate more comments. In the beginning phase, the comments emphasized the need to do everything right, and the lack of control. By the late phase, a large number of comments were positive in nature. The proportion of comments related to feelings decreased steadily over the phases (29.41%, 24.17%, and 17.90%). Despite the decrease, feelings still occupy the second highest group in both the middle and late phases. It is worth noting that by the middle phase the feelings were becoming more positive, and by the late phase, all the comments except for 1.85% were positive. The number of comments related to the focus of the procedure varied only slightly across the three phases (18.10%, 18.01%, and 16.67%). Of importance here is the change from the focus being primarily on the task in the beginning phase, to more emphasis on the patient in the middle phase, to total focus on the patient by the late phase. This change coincides with the situation noted earlier of students feeling less able to prepare the patient by Injection #3 and the Final Injection and reflects the additional pressure on the students to focus more on the patient even though they are still concentrating on the task. This probably also reflects the instructors' expectations that the student will be able to talk to the patient while giving the injection. The proportion of comments about the cognitive aspect began at 15.84%, decreased to 9.00% in the middle phase, and rose to 15.43% in the late phase. This trend is somewhat difficult to explain since the expected direction was that cognitive activity would decrease as the learning of the skill increased. With this category there was a change in comments from the more negative ("always forgetting something") to the more positive in the late phase "could teach someone else" [how to give injections]). The proportion of comments about the time involved in preparing and administering injections decreased over the phases (21.72%, 20.38%, and 11.11%). Students indicated that speed increases with progression through the three phases.

The phases as described by the students fit most readily with phases as identified by Adler (1981). According to Adler, the concept phase includes forming a mental picture, as well as carrying out the skill while paying attention to the parts. Comments from the study that fit this phase include focus on the task, role of memory, progressing step by step, trying to do everything right, lack of motor control, number of errors (2.26%), and the slowness of the procedure. Adler's second phase is that of adaptation and is characterized by increased accuracy, but still with a focus on some parts of the procedure. Examples from the study include the increase in comments about improvements, increasing speed, more focus on the patient, reduction in errors to .47%, and an increase in knowing about the IM procedure. The final phase is automatic and is characterized by the fact that there is no conscious attention to movements (Adler, 1981). Practice at this point serves to improve memory. This phase is illustrated by examples from the study such as: ability to use all sites for all kinds of patients, increasing level of skill, "the procedure flows", "each step comes naturally", "it is automatic - no stopping to think about each step", increasing confidence, focus is entirely on patient and not on the task or on self, able to remember everything, and can perform the task faster than previously.

From a more general point of view, the study results also fit into Gentile's two phases (1972). The phases include the development of a motor plan and working to be able to consistently meet the goal. Particularly in relation to the second phase comments such as "getting better each time", "more skilled", and "able to give it in all situations" are examples.

Using the Dreyfus Model of Skill Acquisition (cited in Benner, 1984), it would appear that most of the students are in the novice category. They are depending on rules to assist them in performing the skill. There were some comments that suggest a few students may be approaching the advanced beginner level. For example, two students reported "I can think more about what I am doing - could I do it another way?". Another students reported that she "could teach someone else".

Singer's formula for a skilled performance ("skill = speed x accuracy x form x adaptability") also can be related to the phases of learning IM injections (1980, p. 30). As students progressed through the phases speed increased and accuracy improved. Gradually the form improved although for some of the students in the study their efforts were not always efficient. The goal for most of the students by the time of the Final Injection was to perform the skill at a consistent level and to be able to adapt the skill to any situation.

As evidenced by the number of comments generated, the students were able to describe the phases involved for them in learning to prepare and give IM injections.

Strategies Used in Learning Intramuscular Injections

After having given at least three IM injections to patients the students were asked to describe the strategies they used in helping themselves to learn how to prepare and give IM injections. The number of strategies used by the 48 students ranged from 1-9, with a mean of 5.9 and a standard deviation of 1.95. A stem and leaf display (Display 21) illustrates the distribution.

DISPLAY 21

Stem and Leaf Display for Number of Strategies Used

Leaf : units

```
0 : 1
  : 2
  : 333
  : 444444444
  : 55
  : 66666666666666
  : 77777777
  : 88888
  : 99999
```

n = 48

The types of strategies used were grouped and classified, and are summarized in Table 46.

TABLE 46

Classification of Strategies

Category	Frequency	Percentage	Total
REVIEW	156	55.71	156
Mental Practice	69	24.64	
Visualizing	41	14.64	
Verbalizing	28	10.00	

(table continues)

Cagetory	Frequency	Percentabe	Total
Written Material	58	20.71	
IIOS checklist	34	12.14	
Text, notes, articles	24	8.57	
Procedure	22	7.86	
Steps	6	2.14	
Information about medications	6	2.14	
Errors	5	1.79	
Sites	3	1.07	
Needles	1	.36	
What to remember	1	.36	
Method of Giving Injection	7	2.50	
In the lab.	2	.71	
Watching nurses give them	2	.71	
Last injection	1	.36	
On the video	1	.36	
What was liked about past injections received	1	.36	
PRACTICE	68	24.29	68
Simulated	44	15.71	
Landmarking	24	8.57	

(table continues)

Category	Frequency	Percentage	Total
On others	15	5.36	
On self	9	3.21	
Wrist Action	5	1.79	
Practice on Inaminate objects	15	5.36	
Oranges	5	1.79	
Pens	5	1.79	
Object not specified	2	.71	
Teddy bear	1	.36	
Pillow	1	.36	
Sponge	1	.36	
Actual Practice	24	8.57	
Attended extra lab.	10	3.57	
Drawing up medication	8	2.86	
Would have taken equipment home	2	.71	
Giving several injections one after the other was helpful	2	.71	
Practicing other skills helped Eg. giving Intravenous meds.	1	.36	
Manipulating the syringe	1	.36	
INTERACTION WITH THE INFORMATION ABOUT INJECTION PROCEDURE	29	10.38	29

(table continues)

Category	Frequency	Percentage	Total
Questioned others	10	3.57	
Made cue cards	8	2.86	
Memorized	5	1.79	
Grouped items, then categorized	2	.71	
Wrote down the steps	2	.71	
Broke down into sections, then joined sections together	1	.36	
Made associations to aid memory	1	.36	
PREPARATION FOR GIVING INJECTIONS	27	9.64	27
Self-talk	8	2.86	
"This is not mutilation"	1	.36	
Forget own problems - be confident	1	.36	
Focus on patient comfort	1	.36	
"Remember to aspirate"	1	.36	
"Relax"	1	.36	
"Calm down"	1	.36	
"Stop and think"	1	.36	
"Put it out of my mind"	1	.36	
Recite the steps	10	1.79	
To classmates, friends	5	1.79	
To instructor	3	1.07	
To self	2	.71	

(table continues)

Category	Frequency	Percentage	Total
Preparing ahead of time (equipment)	3	1.07	
Interaction with patient	3	1.07	
Think about what to say to patient	1	.36	
Getting to know patient is helpful	1	.36	
Assessed patient's feelings about injections	1	.36	
Aids to Giving the Injection	3	1.07	
Talking to patient while cleansing the site	1	.36	
Depersonalization (seeing only the muscle, not the patient)	1	.36	
Count to ten, then have to give	1	.36	
Total	280	100.00	

Strategies were grouped and classified into four main types: review, practice, interaction with the information about the IM procedure, and preparation for giving the injection. Review strategies accounted for 55.7% of all strategies used, and included mental practice (24.64%), reviewing written material (20.71%), reviewing the procedure for IM injections (7.86%), and reviewing methods used for other injections (2.50%).

Practice strategies (24.29%) were classified according to simulated (15.71%) or actual (8.59%) experiences. Interaction involved doing something with the information about injection (10.38%), and included such activities as questioning others (3.57%) and making cue cards (2.86%).

The category of preparation for giving the IM injection (9.64%) consisted of activities such as self-talk (2.86%), reciting the steps to classmates, and instructor and self (3.57%), and preparing equipment and self ahead of time (1.07%).

It was noted that the most commonly reported strategy was mental practice (24.64%), with the use of visualizing the procedure (14.64%) and verbalizing the steps of the procedure (10.00%) as the components. Ryan and Simons have (1983) reported that performance can improve through the use of mental practice, and the improvement is mainly in the cognitive aspects of the psychomotor skill. Thus, for a skill such as IM injections where the cognitive demands are high, mental practice can be a very appropriate strategy. However, mental practice alone is not enough for "without corrective feedback provided by actual practice, the observer or person using mental rehearsal is unable to identify and correct errors and thus, adjustments and refinements in the motor elements of the skill cannot be made" (Ryan & Simons, 1983, p. 425). Singer and others have reported that in several studies comparing the influence of different strategies in the acquisition, retention and transfer of motor skills, the use of imagery led to a more accurate, and less variable performance (Singer, Gerson, & Ridsdale, 1979a; Singer, Hagenbeck & Gerson, 1981; Singer, Ridsdale & Korienek, 1979b; Singer, Ridsdale & Korienek, 1979c).

The use of the IIOS checklist (Intramuscular Injection Observation Sheet) (12.14%) was also a popular strategy, especially at the beginning of the learning process. Many students reported using the checklist to learn the steps of the process and the correct sequence, while a few used it mainly as a feedback tool after the injection was completed. While the use of self-talk as a strategy was low (2.86%), it is encouraging to see that some students are aware of cognitive reappraisal techniques.

When comparing the classification of strategies used by students in the study with those classification models that appear in the literature no perfect fit was found. In the strategies suggested by C. Smith (1983), there is agreement on visual imagery, verbal mediation, and the usefulness of modeling. Kirby's (1984) suggestions regarding strategies that may influence performance can be related to the study strategies in terms of verbalization, rehearsal in the mind and with others, semantic categorization, and elaboration. With respect to the classification developed by Dansereau et al. (1979), some of the study strategies fit under the comprehension/ retention category.

The best fit of the data to a classification model is with the one developed by Weinstein et al. (1979). The study strategies can be arranged quite well under the five categories of strategies: rote (use of IIOS, cue cards, memorizing, reviewing), physical (practice), imaginal elaboration (mental practice-visualizing the procedure, watching others), verbal elaboration (verbalizing in the mind, doing something with the information, questioning, reading), and grouping (working with the information). This classification system allows for the inclusion of the practice strategies which are an important part of the total strategies used by any students in learning a psychomotor skill.

Students were asked to identify the strategies that were most useful and least useful. The results are summarized in Tables 47 and 48. The most useful strategies were those classified as Review (48.38%), and Practice (33.87%). One student indicated that no strategies were helpful. The strategy she used was to "put it out of my mind so I won't get more anxious". It is worth noting that at the Final Injection (her fifth injection) this student experienced serious problems with drawing up the medication (took three tries to be successful) and with giving the medication (got the needle part way into the skin, and pulled it out,

TABLE 47

Students' Descriptions of the Most Useful Strategies for Learning IM Injections

Category	Frequency	Percentage
REVIEW	30	48.38
In the mind	16	25.81
Written guides	7	11.29
IIOS	6	9.68
Cue cards	1	1.61
Rehearse all steps	5	8.06
Previous injections	1	1.61
Errors	1	1.61
PRACTICE	21	33.87
Actual	18	29.03
Actually doing it	12	19.35
Lab was helpful	4	6.45
Hand movements	1	1.61
Handling equipment	1	1.61
Simulation	3	4.84

(table continues)

Category	Frequency	Percentage
Meat	1	1.61
Pillow	1	1.61
Landmarking on other people	1	1.61
WATCHING OTHERS	4	6.46
Video	2	3.23
Nurses	2	3.23
TALKING TO OTHERS, QUESTIONS	2	3.23
INSTRUCTOR ACTIVITIES	2	3.23
Feedback	2	3.23
ANXIETY	1	1.61
Use of relaxation to reduce it	1	1.61
DEPERSONALIZATION	1	1.61
Focusing only on injection site rather than on patients as a person	1	1.61
NONE WAS HELPFUL	1	1.61
Total	62*	100.00

*Some students cited more than one "most helpful" strategy.

TABLE 48

Students' Descriptions of the Least Useful Strategies for Learning IM Injections

Category	Frequency	Percentage
READING ABOUT INJECTIONS	17	34.69
Books, including text	16	32.65
Hospital manual	1	2.04
PRACTICE	7	14.28
Simulations	5	10.20
Meat	3	6.12
Not enough time with the meat	1	2.04
Landmarking on self	1	2.04
Lab - not enough time	1	2.04
Hand movement	1	2.04
NO STRATEGIES WERE LEAST HELPFUL	6	12.24
LECTURE	5	10.20

(table continues)

Category	Frequency	Percent
INSTRUCTOR ACTIVITIES	4	8.16
No feedback	1	2.04
Hovering over student's shoulder	1	2.04
Grilling student about the drug	1	2.04
Asking student to give injection when she was not prepared to	1	2.04
ANXIETY	3	6.12
Worrying about injections	3	6.12
WATCHING OTHERS	2	4.08
Video (but good for the whole procedure)	2	4.08
TALKING TO OTHERS, QUESTIONS	2	4.08
REVIEW	2	4.08
In the mind	1	2.04
IIOS guide (too many steps)	1	2.04
PRICKING SELF WITH NEEDLE	1	2.04
Total	47*	100.00

*missing case - 1 response not completed requiring that she do the injection again). For this student it would appear that denial (not thinking about injections) was a dysfunctional coping mechanism.

The least useful strategies were reading about injections in the textbook and hospital manual (34.69%). The use of simulations and the classroom lecture each received 10.20% of the negative comments. Some of the comments indicated that all of the strategies used were helpful (12.24%), and none were identified as not being helpful. Of some concern is the category of Instructor Activities. Here 8.16% of the comments were related to instructor activities that were not helpful. These included giving no feedback, "hovering over my shoulder", "grilling me about the drug", and "being asked to give an injection when I was not prepared to do so".

The number of strategies used was positively related to the total number of manual tasks that the student reported having experienced (r=.48, significant at 0.01 level). The tasks included handicrafts, playing musical instruments, and work-related activities such as typing and operating a cash register. When the relationship between these individual tasks and the number of strategies used was examined, significant correlations (at the 0.05 level) were obtained for handicrafts (r=.39) and for work-related activities (r=.24) but not for playing musical instruments (r=.22). Perhaps the learning of such activities requires the use of a number of different strategies that can then be transferred to other manual skills. For example, several students reported using some type of practice strategy involving the use of simulations for learning both previous manual tasks and IM injections.

There was no significant relationship between the number of strategies used and any of the performance measures on Injection #2. However, on Injection #3, there was a significant (at the 0.05 level) but negative relationship between the number of strategies and the Time taken to Prepare and Administer the injection (r=-.39 [Preparation], r=-.26 [Administration]). In other words, the more strategies used, the less time it took to prepare and administer the injection. The relationship between the number of strategies and the total performance score on Injection #3 was also significant (r=.27, p = 0.05). On the Final Injection the relationship between the number of strategies and both the Administration score and the Total score was significant at the 0.05 level (r=.27 and .30 respectively).

The relationship between the number of strategies reported and the performance scores suggest that the more strategies a student utilizes, the higher the performance scores are likely to be. When the top one-third of the students and the bottom one-third of the students (based on the mean of the performance scores for all three injections) were compared in terms of the number of strategies used, the results were as follows. The top group had a mean performance score of 92.65% , and an average of 6.63 strategies. The range of the number of strategies used was between 4 and 9, with three of the students using the maximum number of strategies reported (9). The standard deviation was 1.78. The low group had a mean performance score of 82.79%, and an average of 5.25 strategies. The range of the number of strategies used was between 1 and 9, with several students using the fewest number of strategies reported. The standard deviation was 2.21. The pooled variance estimate approached significance (p = 0.06) with a t = -1.94, and df = 30. The relationship between the number of strategies used and performance is further illustrated by the strong significant negative correlation with the number of errors made on the Final Injection (r=-.41, significant at the 0.01 level). The more strategies that the students used, the fewer the number of errors made on the Final Injection. Significant correlations (at the 0.05 level) were also obtained relating the number of strategies used to the instructor rating of skill on the Final Injection (r=.32) and to being allowed to give IM injections without supervision (r=.33).

Biggs and Kirby (1980) have indicated that "strategies are specific to a task and are teachable" (p. 212). It should be possible to identify the strategies that are required for the effective solution to a particular task, and then to provide instruction to the student in how to use those strategies. For instance, if some students are struggling and shaking while drawing up medication into a syringe, useful strategies could be repeated trials of actually drawing up the medication from a variety of containers, additional work on calculating dosages, and the use of anxiety reduction techniques. Biggs and Kirby have also maintained that "qualitative families of strategies exist that cover a fairly broad band of tasks" (p. 212). If this is so, then it should be possible to identify and teach general strategies that students could use to assist in the learning of a variety of nursing skills.

Biggs (1978) has postulated that when students are faced with a task, they choose strategies on the basis of how they perceive the task, what is required in the learning situation if they are to meet their goals, and their own ability. Biggs (1984) has reported that "high achieving students spontaneously select and use appropriate strategies" according to what "make(s) sense in their scheme of things" (p. 130). On the other hand, it appears that low achieving students do not choose strategies in keeping with their "scheme of things", and tend to use the selected strategies in inappropriate ways. Biggs (1984) recommends that underachieving students would benefit from being taught task specific strategies, regardless of their motivations and their usual processing methods. For these low achieving students it appears that almost any strategy will help improve their performance and will result in their feeling better about their performance.

Evaluation of Teaching Strategies

The teaching strategies used in instructing students about intramuscular injections included lecture, simulation, videotaped demonstration, and return demonstration. Since no formal evaluation of the effectiveness of the teaching strategies had been done previously, students in the study were invited to evaluate each strategy, and to offer suggestions for change. Although some information was recorded at the end of the class and laboratory experience, the major portion was collected at the time of the second interview (after each student had completed a minimum of three injections with patients). This timing allowed the students to see the instructional strategies within the overall context of both the theoretical and practical study of injections. The comments for each of the strategies were tape-recorded, and then transcribed. Analysis of the comments resulted in identification of major themes. Selected examples will be included.

Lecture Presentation. In an 80 minute presentation, the theoretical material regarding needles, syringes, ampules, vials, injection sites, types of injections, and the dangers of injections was discussed. Overhead projections were used to illustrate injection sites and the location of potentially dangerous structures such as major blood vessels and nerves. Actual injection equipment was available for the students to see and handle. From the investigator's perspective the material was presented in an effective and creative way. However, the amount of material presented was extensive, and may have been overwhelming, especially in light of the fact that the students were anticipating giving injections to each other upon completion of the class. In addition, students were presented with a range of options regarding size and type of equipment and variation in the injection procedure. According to Dreyfus and Dreyfus (1980) (cited in Benner, 1984) the novice needs to be given general rules to guide their practice. This lack of rules was evident when at the time of the Final Injection a number of students were unable to select the correct size of needle for the most general case of an adult patient of average size.

Student comments about the lecture are presented in Table 49.

TABLE 49

Students' Evaluations of the Lecture Presentation on IM Injections

	Frequency	Percentage	Total
POSITIVE STATEMENTS	91	83.49	91
Overall Evaluation	46	42.20	
Good	12	11.01	
Informative	10	9.17	
Helpful	9	8.26	
Reinforced pre-reading	3	2.75	
Led to careful thinking about IM's	3	2.75	
Helped with practice session	2	1.83	
Better than reading in text	2	1.83	
Enjoyable	2	1.83	
Good diagrams	2	1.83	
Helped with expectations	1	.92	
IM Procedure	41	37.61	
Types of needles	15	13.76	
Sites	9	8.26	
Landmarking	9	8.26	
Seeing the equipment	6	5.50	

(table continues)

	Frequency	Percentage	Total
Demonstration	1	.92	
Technique	1	.92	
Feelings	4	3.67	
Good to be aware of dangers	3	2.75	
Not so terrifying	1	.92	
NEGATIVE STATEMENTS	18	16.51	18
Overall Evaluation	8	7.34	
Too much information	3	2.75	
Handout would be helpful	2	1.83	
Too long	1	.92	
Difficult to understand at times	1	.92	
Contradictions (lecturer & others)	1	.92	
IM Procedure	5	4.59	
Needles were confusing	3	2.75	
Too much focus on one site	2	1.83	
Feelings	5	4.59	
Increased anxiety	2	1.83	
Too much emphasis on "injection day"	2	1.83	
Scary	1	.92	
Total	109	100.00	

The students in the study (n=48) produced a total of 109 responses related to the lecture presentation. Of these responses, 91 were positive statements (83.49%), while 18 were negative statements (16.51%). Within these major headings of positive and negative comments, three main themes were identified: overall evaluation, IM procedure, and feelings.

While only a few negative comments were made, the concerns raised require attention. One concrete suggestion is that a handout be developed to provide information on the gauge and length of needles, and criteria to use in deciding which one is appropriate to use in a particular situation. Some students found the lecture comments about needles to be "confusing", and wanted to have a guide to which they could refer when in the clinical area. Part of the need for a handout was due to the fact that the section on intramuscular injections in the students' textbook was inadequate. At the time of the final injection, the investigator discovered that several students were still unclear as to which needle to use, even in the most general case of an "average-sized" adult.

Two comments indicated a concern that there was too much emphasis on one site (the ventrogluteal muscle). The classroom lecturer did state a definite preference (along with her rationale) for using this site.

> I think she could have gone over the sites a little more closely because it tended to focus more on the

> one site. A bit more on all of them would help because once you hit clinical, and you are all of a sudden with a patient who pulls up their sleeve and says 'give it here', and you are going 'but I forget how to do it in the arm'.

A final concern is students' feelings. Five statements (4.59% of all responses) indicated that the lecture was "anxiety producing".

> I was a bit more, not scared to death or anything, but when she pointed out all the dangers and the damage you could do by just using the wrong landmark or not aspirating enough, it was enough to put a good scare into you.

Some students indicated that too much stress was placed on injections.

> I think they put too much emphasis on it. Like 'today is injection day!'. They don't say that about dressings or other skills.
>
> 'This is D-day' - her comment may not have taken into account all the anxiety we were feeling.

In summary, the comments about the classroom presentation were mainly positive, although specific concerns were mentioned.

Simulation. At the beginning of the two hour laboratory session, the students were divided into groups of five or six. Each group was supervised by a clinical instructor. The instructor began by demonstrating how to draw up medication (in this case, sterile normal saline) into a syringe and how to inject it into a piece of flank steak. Each student then had an opportunity to do the same. Depending on the amount of time available, students gave from one to ten injections to the meat, with most giving two or three. The purpose of injecting the meat is to allow the student to experience the resistance of the tissue, and to begin to get the feel of how much force is required to insert the needle in one smooth motion. Since it is just "a piece of meat", it is anticipated that the students' anxiety will be such that learning is facilitated. Student comments about the stimulation are presented in Table 50.

TABLE 50

Students' Evaluations of Giving IM Injections in the Learning Laboratory - Simulation (Meat)

Category	Frequency	Percentage	Total
POSITIVE STATEMENTS	112	78.32	112
Overall Evaluation		50	34.97
Helpful		16	11.19
Easy		12	8.39
Realistic		8	5.59
Fun		5	3.50
Good		4	2.80
Okay		3	2.10
Surprising		2	1.40
IM Procedure		39	27.27
Feel of giving needle		12	8.39
Wrist action		8	5.59
How much force to use		6	4.20
Idea of putting needle in		4	2.80
Good for drawing up medication		4	2.80
How fast to do it		2	1.40
How to hold syringe		1	.70
Steps of procedure		1	.70
Feedback from instructor		1	.70

(table continues)

Category	Frequency	Percentage	Total
Feelings		23	16.08
Low anxiety		7	4.90
Wanted to do more		5	3.50
Good to do before "doing" a person		4	2.80
Meat could not react		4	2.80
Increased confidence		2	1.40
Eager to do it		1	.70
NEGATIVE STATEMENTS	31	21.68	31
Overall Evaluation		23	16.08
Not realistic		14	9.80
Too rushed		5	3.50
Too crowded		2	1.40
Not helpful		1	.70
Not necessary		1	.70
IM Procedure		1	.70
Feelings		7	4.90
Surprised did not practice more before giving to humans		2	1.40
Not the same symbolic meaning as real muscle		1	.70
Queasy		1	.70

(table continues)

Category	Frequency	Percentage	Total
Highly anxious generally about IM's	1		.70
Nothing can prepare you		1	.70
Felt stupid doing it		1	.70
Total		143	100.00

Forty-eight students gave 143 responses related to the use of the meat as a simulation. Of these responses, 112 were categorized as positive statements (78.32%), and 31 were designated as negative comments (21.68%). Under the main headings of positive and negative statements, three themes developed. These were the same as for the lecture presentation: overall evaluation, IM procedure, and feelings.

A total of 50 responses (34.97%) positively evaluated the overall experience, and described it as "helpful", "easy", and "realistic", "good" and "fun". In relation to the IM procedure it appears that the simulation does assist students to "get the feel of giving a needle" (8.40%), get an idea of the "force" and "speed" required, and allow for practice of the "wrist action" (5.60%).

> Putting it into the meat - we were all skeptical about how to put it in correctly, you know, with a flip of the wrist. We weren't expecting the feel of the meat to be quite so close to being like the skin. I did it three or four times into the meat - until I felt more confident with the wrist action and how hard to plunge.

Other responses related to getting used to the idea of putting a needle into something.

> I think it was easier giving it to the meat, than actually giving it to someone. I think that helped you get over your actually putting a needle into somebody. You could just practice since you were not hurting the meat.

When negative statements were examined, it was noted that 14 responses (9.80%) indicated that the simulation was not realistic. One student, however, acknowledged that "it was more realistic than fruit" (such as the oranges and grapefruits often used in the past). Only one response indicated that the simulation was not helpful, while one other response implied that the student did not think that the simulation experience was necessary. Seven responses (4.90%) criticized the organization of the simulation experience, stating that it "was too crowded around the meat" and "too rushed". Some students would have liked more time to experiment with the meat "to get used to the feeling of it"; for others, one or two injections into the meat was enough.

The majority of students viewed the simulation in a positive way, and some would actually have liked more time to "play around with the meat". One comment sums up the usefulness of the simulation:

> I was glad we got to practice on something before we did it on each other.

Demonstration (Videotape). Following the simulation, the students watched a videotaped demonstration of the classroom teacher preparing and administering IM injections to the investigator. Two muscle sites were demonstrated: ventrogluteal and dorsogluteal.

Analysis of the students' statements resulted in a division into positive and negative descriptions and the identification of four themes: IM procedure, overall evaluation, feelings, and patients' responses. Table 51 is a summary of the students' evaluations of the videotape.

TABLE 51

Students' Evaluations of Videotaped Demonstration Used During the Laboratory Session

Category	Frequency	Percentage	Total
POSITIVE STATEMENTS	129	96.27	129
IM Procedure	60	44.78	
Technique of how it is done	11	8.21	
Communicating with patient (preparing and explaining)	10	7.46	
Showing landmarking	8	5.97	
Showing all the steps	8	5.97	
Seeing the whole procedure	8	5.97	
Positioning the patient	3	2.24	

(table continues)

Category	Frequency	Percentage	Total
Seeing how the nurse reacted	3	2.24	
Techniques to relax the patient	3	2.24	
Drawing up medication	2	1.49	
Checking the identification of the patient	2	1.49	
Comforting the patient	1	.75	
How to approach the task	1	.75	
Overall Evaluation	57	42.54	
Helpful	17	12.69	
Good	7	5.22	
Reinforced the information	5	3.73	
Useful seeing a real live patient	4	2.99	
Was a review	4	2.99	
Better than reading about it	3	2.24	
Could imitate the model	2	1.49	
Interesting	2	1.49	
Good explanation of procedure	2	1.49	
Informative	1	.75	
Pictured it well	1	.75	
Looked easy	1	.75	
Easier to learn from watching	1	.75	
Put everything together	1	.75	

(table continues)

Category	Frequency	Percentage	Total
Watching increased memory	1	.75	
Knew the role model	1	.75	
Good role model	1	.75	
Better than the class	1	.75	
Looked professional ("not gross")	1	.75	
Looked clear cut	1	.75	
Feelings	7	5.22	
Decreased anxiety	5	3.73	
Increased confidence to try it	2	1.49	
Patient's Response	5	3.73	
Not afraid	1	.75	
Feelings are involved	1	.75	
Responded well	1	.75	
Injection did not hurt	1	.75	
Lived through it	1	.75	
Negative Statements	5	3.73	5
IM Procedure	0	0	
Overall Evaluation	4	2.99	
Hard to see	2	1.49	
Not too helpful	2	1.49	

(table continues)

Category	Frequency	Percentage	Total
Feelings	1	.75	
Concerned by some bleeding after the injection	1	.75	
Patient's Response	0	0	
Total	134	100.00	

The subjects in the study (n=48) put forward 134 statements about the videotaped demonstration. Of these, 129 responses (96.27%) were positive. The five negative responses (3.73%) were related to difficulties in seeing due to the crowded condition in the lab (2), finding the tape not too helpful (2), and concern about some bleeding that appeared on the skin of the patient after one of the injections (1). The following comments illustrate how the videotape was beneficial.

> It was very helpful. It showed the actual procedures, a person actually doing it, and for me I can remember it better from watching, observing, than from somebody telling me about it. It showed her swabbing the skin, positioning the patient, helping the patient to relax, and giving her the needle. It sort of decreases your anxiety because you think, okay, I've seen somebody do it, now I can imitate that. A sort of goal, a good role model.
>
> It was good. Just seeing it done. And if you [the investigator] could volunteer for it, then it can't be that bad. Because that's what I think made us decide we could let each other

> give one. It was not that we were afraid of giving the needle, but we didn't want to receive it.
>
> It was good because it showed the whole thing, from start to finish. It was done on a human, and the person had feelings. The nurse had to communicate what would happen, and get the patient into the right position. It looked quite easy so it gave us confidence to go in and do it.

Injecting a Peer. Following the viewing of the videotaped demonstration students prepared to give an IM injection to each other. The students worked in pairs, each having a turn as the "patient" and the "nurse". The instructors carefully supervised the situation from a safety and a support point of view. Each student drew up the sterile normal saline into the syringe and gave an IM injection into the ventrogluteal site of her partner, while the other students in the group watched. The conditions in the lab were not ideal; it was quite crowded, and some students had to rush through their injections due to time constraints.

Students' comments about the experience of giving injections to peers are summarized in Table 52.

TABLE 52

Student's Evaluations of Giving IM Injections in the Learning Laboratory - Injecting a Peer

Category	Frequency	Percentage	Total
OUTCOMES	84	42.42	84
Positive Statements	84	42.42	
Good	20	10.10	
Went well	18	9.09	
Helpful	16	8.08	
Did not hurt	10	5.05	
Enjoyed it	7	3.54	
Better than expected	3	1.52	
Not that bad	2	1.01	
As expected	2	1.01	
Easy	2	1.01	
Pleased	2	1.01	
Needle goes in easily	2	1.01	
FEELINGS	44	22.22	44
Negative Statements	32	16.16	
Nervous	16	8.08	
Shaky	6	3.03	

(table continues)

Category	Frequency	Percentage	Total
Scared	3	1.52	
Nerve-wracking	2	1.01	
Concentrated on each step	2	1.01	
Stressful	1	.51	
Task-oriented	1	.51	
Sigh of relief	1	.51	
Positive Statements	12	6.06	
Not nervous	4	2.02	
Decreased anxiety	3	1.52	
Comfortable	2	1.01	
Not hesitant	1	.51	
Overconfident	1	.51	
Creative	1	.51	
ADVANTAGES	35	17.68	35
Ready for peer but not patient	5	2.53	
Chance to watch others do it	4	2.02	
Supportive group	3	1.52	
No time to think - just do it	3	1.52	
Nothing is as good as doing it	2	1.01	
Ways to decrease client anxiety	2	1.01	

(table continues)

Category	Frequency	Percentage	Total
Relaxed atmosphere	1	.51	
Lots of trust	1	.51	
Feel better for doing it	1	.51	
Client was honest and accepting	1	.51	
No client to hear the feedback	1	.51	
Privacy of setting - realistic	1	.51	
Something we all shared in	1	.51	
Can tell anxious patients we did them to each other	1	.51	
Good to do first without drugs	1	.51	
Good for landmarking	1	.51	
Didn't have to make a patient nervous	1	.51	
Would be more stressful with a patient	1	.51	
Increased confidence	1	.51	
Increased sympathy for patients	1	.51	
Good experience to get a needle even if scared	1	.51	
Prepares us for things that can happen in clinical areas	1	.51	

(table continues)

Category	Frequency	Percentage	Total
CONCERNS	28	14.14	28
About getting a needle	6	3.03	
Response of client	3	1.52	
Unsure of partner's ability	3	1.52	
Afraid of causing pain	3	1.52	
Putting needle into client	2	1.01	
Getting up nerve to do it	2	1.01	
Was client's first IM	2	1.01	
Afraid of doing something wrong	1	.51	
Dealing with a real person	1	.51	
Afraid of hitting bone	1	.51	
Might move the needle - pain	1	.51	
Would I do well?	1	.51	
Afraid of air bubbles	1	.51	
Scared of needles	1	.51	
PROBLEMS	7	3.54	7
Had to do it twice to get needle in	2	1.01	
Hurt client	2	1.01	
Hit a blood vessel	1	.51	
Aspirating was difficult	1	.51	
Let go of the syringe	1	.51	
Total	198	100.00	

The students in the study (n=48) provided a total of 198 responses evaluating the experience of giving IM injections to peers. More comments were related to this teaching strategy than any other, leading to the conclusion that this experience was more important to the students and produced more reactions. The comments were arranged in five categores: outcomes (positive), feelings (both positive and negative), advantages, concerns, and problems. Positive statements accounted for 66.16% of the comments and included the sum of positive outcomes (42.4%), positive feelings (6.06%), and advantages (17.68%). Negative statements, including negative feelings (16.16%), concerns (14.14%), and problems (3.54%) made up the remaining 33.84%.

The giving of one's first IM injection is a stressful situation. It is not surprising that students described negative feelings and experienced concerns about the procedure. One student expressed her concerns this way:

> I found it very nerve-wracking. Like drawing it up was fine, but actually giving it to her, the nerves went up. I'm sure it probably hurt me more than it did her. I was a wreck after doing it.

Students were concerned about hurting the client or causing some type of damage. For example:

> I didn't have any trouble with drawing it up or figuring anything out. My fear was just making sure that I did not put it into a bone.

The problems experienced by the students were similar to those that happen with real patients in the clinical area: not getting the needle in on the first try, causing discomfort, hitting a blood vessel, and letting go of the syringe while trying to aspirate. The fact that these problems happened in the supportive atmosphere of the laboratory probably helped to diminish the impact.

> It was good, really good. I didn't get the needle to go in the first time because I was afraid I was going too hard, but the second time it went in and after that it was no problem at all.

Despite the negative comments, the majority of the students found the experience very beneficial.

> I found it was really quite good. I found my injection that I received to be painless, and the girls that I gave to said hers was painless as well. We all did really good injections, all four of us, if you can believe it.
>
> I felt really comfortable, and I was pleased with myself when I was done. I liked doing it on my friends because it was something we all shared.
>
> I was terrified to give it to someone, so it helped a lot. For someone to say 'yeah it didn't hurt', or 'are you done? 'really helped.
>
> I would have hated to just go right into the hospital and try and do it.
>
> It gave me a chance to see other students react when they got their first IM injection, and that served to emphasize the importance of communicating with the patient to help relieve their anxiety.
>
> It was nice to have the instructors there because then you could get feedback right away without having the patient sit there and hear everything.

In summary, while some negative comments were made, they were ones that could be expected whenever or wherever the students gave their first IM injections. It appears from the positive comments that the laboratory setting provided close supervision and reassurance from the instructors, and the support and encouragement of classmates, thus creating an appropriate atmosphere for practice of a new skill, IM injections. From the instructors' point of view, it is much easier to be supportive and to provide the assistance the students need in the relatively controlled laboratory setting. At the end of the laboratory session, one student commented:

> We figured that since you instructors were willing to let us give injections to each other, then it must not be so bad. Your confidence in our ability to do the task safely really helped.

Suggestions for Improving the Teaching of IM Injections. Throughout the comments evaluating the teaching strategies, suggestions were made for improving the teaching of IM injections. Two major themes emerged from the analysis of the comments. A number of students wanted the opportunity to give more injections, and others wanted to see the organization of the experience improved. A summary of the suggestions is presented in Table 53.

TABLE 53

Students' Suggestions for Improving the Teaching of IM Injections

Suggestion	Frequency	Percentage	Total
GIVE MORE INJECTIONS	45	73.77	45
Try other sites	13	21.31	
More chance to practice landmarking	8	13.11	
More time in the lab	7	11.48	
Give more than one injection	6	9.84	
More practice	4	6.58	
Give to more than one person	3	4.92	
Give one to self	1	1.64	
Would have received more practice needles	1	1.64	
Each person do a different site	1	1.64	
Do subcutaneous injections also	1	1.64	
OVERALL ORGANIZATION OF EXPERIENCE	16	26.23	16
Do more injections on another day	3	4.92	
Needs to be better organized	2	3.28	
More time for the lecture	2	3.28	
Prepare a handout	2	3.28	

(table continues)

Category	Frequency	Percentage	Total
Have lab first, then the lecture	1	1.64	
Class one day, lab the next day	1	1.64	
One group in lab while other group is in class	1	1.64	
Fewer students in the lab at one time	1	1.64	
Spend more time with the meat	1	1.64	
Too much information all at once	1	1.64	
More doing, less talking	1	1.64	
Total	61	100.00	

The students in the study (n=48) generated 61 suggestions for improving the teaching strategies. Since 45 or 73.77% expressed the desire to have an opportunity to give more injections, the usefulness of having students give injections to each other appears to outweigh the cost of sterile supplies and the need for close supervision by the instructors. Several students, commenting on the usefulness of doing the injection in the laboratory remarked that:

> When the patient asked if this was my first injection I could truthfully say that it was not. This gave both of us more confidence.

> I wish we could have more experience trying it on each other. I would have like to have done two before actually giving one to a patient.
>
> More practice drawing up the medication would have been helpful.
>
> I think practicing the other sites would be good because I ended up giving them on other sites at the hospital, but I never did learn them in class.

In summary, for these students the teaching strategies used were positively received. The main negative comments related to the overall organization of the learning experience and the apprehensions inherent in giving IM injections. A number of suggestions were made regarding ways to improve the teaching of IM injections.

CHAPTER V

Summary, Conclusions and Implications

In this final chapter, a summary of the study is presented. Conclusions based on the data are explored, and recommendations are made. Implications of the study for nursing are described and areas for future research are identified.

Summary

Very few studies can be found in the nursing literature that apply learning theory to the acquisition of psychomotor skills. This lack may be due in part to the fact that psychomotor skills may be given a low priority in many nursing curricula. As a result, the new graduate may begin working as a nurse, handicapped by a lack of expertise in the performance of the basic psychomotor skills required by the profession.

This study was designed to describe in detail the learning of an important psychomotor skill in nursing, that of intramuscular injections (IM's). As part of the learning experience, second year baccalaureate nursing students shared their comments about the phases of learning the skill, the strategies used in learning the skill, the concerns and feelings regarding injections, the differences between giving injections to children versus adults, and the effectiveness of the teaching strategies used. Data were collected to determine if certain personological variables such as age, academic achievement, anxiety, manipulative dexterity, self-efficacy, self-esteem, and knowledge of asepsis and IM's affected the performance of giving intramuscular injections.

The study population consisted of forty-eight second year baccalaureate nursing students who volunteered to participate. At the time of the study, these students were enrolled in an adult-child nursing course, and as part of that course, were learning to prepare and administer intramuscular injections.

Both qualitative and quantitative methods of data collection and data analysis were used. Data were collected in several ways: participant observation with varying degrees of involvement (complete observer of the lecture, and participant-as-observer of the demonstration and the practice session in the laboratory); semi-structured interviews before, during, and at the end of the study; measurement of anxiety (STAI-Trait and State and Form B), manipulative dexterity (GATB), self-esteem (SEI), self-efficacy (Form A), knowledge (knowledge test), and performance of preparing and administering three IM injections to patients (IIOS); and age and academic achievement (examination of student files). Form A and Form B were developed to investigate self-efficacy and anxiety respectively, in relation to specific steps in the IM procedure. Descriptive statistics, correlations, and analysis of variance techniques were employed. The qualitative data were examined and categorized. Frequency and percentage distributions were used to summarize the data.

Conclusions

Research Questions. Conclusions with respect to the research questions are described.

1. What, if any, phases are involved in the learning of (IM injections)?

Within the framework of a beginning, middle and late phase the students were able to describe each phase in relation to the learning of IM injections. The descriptions of each phase were classified under the five headings of technical, feelings, focus of the procedure, cognitive aspects, and time.

In the beginning phase, the order of comments (according to frequency) was as follows: feelings (anxiety), time (being slow), focus of the procedure (on the task), cognitive aspects (memory, problems, thinking), and technical (doing things right and lack of control).

In the middle phase the order of comments (according to frequency) was as follows: technical category (improvement, specific parts of the procedure, supervision), feelings (anxiety, increased confidence), time (less time involved), focus of the procedure (mainly on the patient), and cognitive aspect (thinking, metacognitive, memory).

By the late phase, the order of comments (according to frequency) was as follows: technical category (can find all sites on all patient, increasing skill level), feelings (all positive), focus of the procedure (totally on the patient), cognitive aspect (remember everything, metacognitive, "knowing I can do it"), and time (can perform faster).

The phases as described by the students are consistent with the three phases (concept, adaptation and automatic) identified by Adler (1981).

2. What, if any, strategies do nursing students use in learning to give IM injections?

The strategies reported by the students were grouped and classified into four main types: review, practice, interaction with the information about the IM procedure, and preparation for giving the injection. Review strategies accounted for 52% of all the strategies used and included mainly mental practice and the review of written material. Practice strategies, including both simulated and actual experiences were reported (22.67%). Interaction with the information about the procedure (9.67%) included such activities as questioning others, making cue cards, and memorizing. The category of preparing for the procedure (7.67%) consisted of activities such as self-talk and reciting the steps.

The most frequently reported strategy was mental practice (23%) which included visualization of the procedure and/or verbalization of the steps of the procedure. The next most popular strategy was the use of the Intramuscular Injection Observation Sheet (IIOS) (11.33%) for learning the steps for reviewing and for feedback following the injection.

3. How does the level of manipulative dexterity affect performance of IM injections?

The most dextrous students in the group obtained significantly higher Administration and Total scores on Injection #3 only. The other measures of manual dexterity and finger dexterity were not significant in relation to performance. The results suggest that manipulative dexterity as measured by the five GATB subtests has little effect on performance early in the learning process. Previous experience with crafts, musical instruments and work-related tasks such as typing had varying effects on performance: Equipment and Recording Scores on Injection #3 were increased, Administration Scores were higher on the Final

Injection, it took longer to give the Final Injection, and the Preparation Scores on the Final Injection were lower.

4. What effects does anxiety have on the performance of IM injections?

Scores obtained from the STAI-State at the time of the pretest and all the injections, showed an increase with Injection #2, and then a steady decrease over the remaining injections. Form B scores (anxiety related to injections) showed a steady decrease across all six occasions. These tools were sensitive in detecting anxiety present in the injection situations. The most anxious students, based on Form B scores, took more time to administer their injections, but on two of the three injections achieved higher performance scores. This finding suggests that some anxiety may be useful in helping the student focus attention on the situation at hand.

The high anxiety students had lower self-efficacy scores, rated themselves as being less skilled at preparing and administering injections, and rated themselves as having less confidence in preparing and administering injections. While the anxiety per se did not appear to affect performance directly, it did seem to alter these students' perceptions of how well they could do the skill. If these students had received assistance to reduce their anxiety, would they have obtained even higher performance scores? This question remains unanswered.

5. What effect does self-esteem have on the performance of a IM injections?

The anticipated negative relationship between anxiety and self-esteem was obtained in the study. Those students who were most anxious displayed low self-esteem. Although the total group scored in the "high" category, several students were identified as having particularly "low" levels of self-esteem (especially in relation to personal self-esteem). In terms of performance, those students with high self-esteem tended to give Injection #3 in less time and had higher performance scores. High self-esteem students gave themselves high ratings for both skill level and confidence in giving IM injections.

6. What effects does self-efficacy have on the performance of IM injections?

The levels of self-efficacy increased with each injection experience. This supports the idea that successful performance of the task is the best guide in altering the level of self-efficacy. The effect of self-efficacy on performance was mixed. Those with high self-efficacy actually had lower performance scores across all the injections, although only the Preparation score of Injection #3 was significantly different. High self-efficacy students took less time to prepare and administer Injection #2. On Injection #3 and the Final Injection the high self-efficacy students took less time to prepare the injections but more time to administer them. The fact that several of these students gave injections to children may account for the mixed picture in relation to time taken to prepare and administer the injections. The findings of lower performance scores with high self-efficacy were not expected.

7. Does age affect the performance of IM injections?

There was a slight positive relationship between age and the performance scores obtained for Injection #2 and the Final Injection. However, on Injection #3, the older students tended to score somewhat lower than the younger students. The strongest relationship between age and performance scores occurred with the time spent preparing the Final Injection. The older students took more time to prepare that injection. Generally, the older students experienced less anxiety in relation to all four injections but it was not significant enough to raise their performance scores.

8. Is there a relationship between academic achievement and the ability to perform IM injections?

The level of knowledge about injections did not affect the performance of the three injections. This may in part be related to problems inherent in the knowledge test that was used. Knowledge about injections improved as the students gained more experience with giving injections.

The only significant difference between the top academic and the low academic students with respect to performance occurred on the Equipment and Recording score on Injection #2. Apparently the top students had a better understanding of how to dispose of used equipment safely, and how to record the injection appropriately.

No significant differences were noted on tests of Coordination, Manual Dexterity, or Finger Dexterity, thereby not supporting previous research findings that suggested a relationship between academic achievement and coordination (Ismail & Gruber, 1967).

Issues

Based on the study, four main issues have been identified. These include: the difficulties students experience in coping simultaneously with the IM procedure, their own emotional responses, and the patient's responses; the dependence of the novice on rules; the development of procedural, declarative, affective, and metacognitive knowledge; and the need for practice.

Inherent in the injection situation are three main factors: the actual injection procedure, the patient's emotional reaction to the situation, and the student's own emotional reaction. When beginning to learn to give injections, students have difficulty coping with their own emotional responses and at the same time, being able to focus on the steps of the procedure. It is very unrealistic to expect that students would also be able to talk to the patients during the procedure. Kirby (1984) has pointed out that when a new skill is being learned, the many dimensions of the task use up all the available processing resources, making it "difficult or impossible to carry on a conversation" (p. 58). For some students, the only way to cope with their own feelings regarding having to stick a needle into someone, is to focus all their attention on the site for the injection. They divorce the muscle site from the person it belongs to. Field (1981) has described the situation clearly:

> To give the injection, I must go beyond the surface existence and mutilate the existence of the other. I no longer see man in his worldly image as a whole; he becomes a study of anatomy imagined in my mind, a network of blood vessels, muscles and nerves. The skin

> is stripped away and the anatomical self is exposed to my imagined reality. I envisage an area as the target for my dart and aim for the bulls-eye at its centre. If the patient stays motionless, it enhances my sense of the human body as object. The stillness creates the feeling that the patient has become an object - has become one with his body. The surrounding world in which his existence was a reality disappears. If he moves, in that very moment, the 'objectness' of the body is destroyed. (p. 294)

To force these students, in the early phase of skill learning, to acknowledge the person attached to the muscle may be detrimental to the learning process.

In the beginning, the learner or novice is dependent upon remembering all the rules related to injections. There are rules about the following: which gauge and length of needle to use under which circumstances; how to mix several medications in one syringe; the "5 rights" of medication preparation and administration; aseptic technique (which parts of the equipment can be touched and which parts must be kept sterile); regulations regarding the handling, discarding, and recording of federally controlled drugs; how to prepare the patient physically and emotionally for the injection experience; how to landmark to find the correct site; how to safely dispose of used syringes and needles; and how to record the giving of the medication. With this overload of information it is not surprising that students experience difficulty with various aspects of the procedure. At this point students are trying to gain procedural knowledge of injections or the "how to do it" (Wall, McClements, Bouffard, Findlay & Taylor, 1985). At first, a great deal of conscious control is required in terms of remembering the steps and the proper sequence. Having to consciously think about each part of the procedure definitely limits performance. With practice, the procedure becomes automatic, and the performance of the skill is smooth and fluid.

The student also gains declarative knowledge, or knowledge about the action (Wall, et al., 1985). Here the student learns such things as the force required to insert a 1 1/2 inch needle into muscle tissue, and the resistance of skin.

Affective knowledge, or feelings about the skill, can be a very important factor (Wall, et al., 1985). The concerns expressed by the students in the study such as worrying about "stabbing the patient to death", indicate the strength of the feelings initially associated with this particular skill. Field comments that the words "'shot' and 'stab' are associated in our minds with violence, with assault upon another person. If I shoot or stab I hurt the other and so cause him pain" (1981, p. 292). As students develop competence in performing the skill, confidence and self-efficacy are increased. Over time, the cumulative effect of successes can result in a more stable self-concept. On the other hand repeated failures can lead to learned helplessness, a state of believing that one is unable to do the task (Abramson, Seligman, & Teasdale, 1978).

Students also develop metacognitive knowledge, or knowledge of what they are able to do (Wall et al., 1985). This includes knowledge about cognitive processes and strategies to assist in learning the skill. Metacognitive skills involve planning, monitoring, and evaluating, and are often used in problem solving situations. An aspect of this is the concept of anticipation, or being able to ascertain what is going to happen, or where something will happen. In relation to injections, the nurse anticipates such things as the amount of tissue resistance, possible movement by the patient, and the emotional reaction of the patient.

A central issue in the development of psychomotor skill acquisition is the amount of practice required in order to become skilled. A study by Crossman (1959) reported that it took normally coordinated women one million trials of cigar making to reach the maximal rate of performance. Kotke agrees, stating that it takes that many repetitions to perfect an engram or a "pathway of interneuronal linkages" which involves the activation of muscles "to perform a pattern of motor activity in a specific sequence of speed, strength, and motion" while at the same time, other muscles are inhibited (1980, p. 553).

Studies in physical education often include the use of up to 8,000 repetitions. This need for extensive practice may explain, in part, the findings of two recent research studies. In a study by Boyd, McKiel, and Murphy (1983), it was found that the group that gave one injection to a pillow with a buttocks drawn on it did as well on the first IM injection with a patient as the group that gave one IM injection to a classmate. This leads to the question of whether a difference would have been noted on later injections. However, in the study it was also found that the group that did not give any injections did not do as well as the groups that gave one injection. A recent study by Hegstad and Zsohar (1986) found that fifteen minutes of practice inserting needles into the veins of a simulated arm made no difference to performance scores at the time of starting an intravenous on a person. Kottke (1980) would argue that one trial, no matter what is involved, would not make a difference to performance.

In nursing, students are expected to master the difficult skill of IM injections after only a few experiences. The successful students are then allowed to give IM injections on their own, without supervision. This reward is somewhat of a double bind; on the one hand, students feel pleased that the instructor trusts them to do well on their own, and on the other hand, they are very anxious about the responsibility of finding the correct site by themselves. Some students recognize the need for additional practice. The student previously mentioned who required hypnosis, spent the night before the laboratory session practicing giving injections to an orange. "I must have given that orange at least 100 injections!". According to Kotke (1980), she is taking the correct approach. This supports the need for additional time in the lab to allow students to "play with the meat", until they feel very comfortable with the wrist action, the force required, and the technique of aspirating.

Recommendations

The measurement of anxiety (STAI-State and Trait, and Form B particularly) was useful in identifying those students experiencing anxiety generally and in relation to injections. The STAI-Trait could easily be administered at the beginning of the term in Nursing 320 to identify those students who are generally anxiety-prone. The STAI-State or Form B could be used with specific injections to follow the progress of the level of anxiety experienced. For those students identified as being anxious specific intervention such as cognitive reappraisal and stress reduction techniques would be helpful in assisting them to function more effectively and comfortably in the clinical setting. At the present time, it is in the second year of the program that the students begin to spend two days per week in the clinical area. Anxious students often report difficulty sleeping the night before clinical experience. As a result, these students come to the hospital setting anxious and fatigued. Anxious students are not just anxious about IM injections; they tend to be generally anxious about performing in the clinical setting.

The identification of students with low self-esteem through the use of the Culture-Free Self-Esteem Inventory for Adults (Battle, 1981) could actually be done in the first year of the nursing program. Although students with low self-esteem are also likely to be the most anxious ones, the SEI gives additional information as to the area of self-esteem that is most affected (general, social, and personal), and therefore would provide more assistance in developing pertinent remedial programs. Coopersmith (1975) has outlined six techniques for building self-esteem: accept feelings as real and support their expression; realize that individuals have different ways of coping (the instructor may have to teach alternate strategies); keep the environment well-structured, stable, and predictable; provide a model of effectiveness (the instructor needs to be confident, and can share personal coping strategies with the students to model how to act and to mobilize resources); help the students develop constructive ways of dealing with difficulties; and maintain self-respect while increasing coping skills (this means giving feedback in privacy and in confidence in a manner that indicates respect and concern rather than rejection or pity). Nursing instructors could make use of all these techniques to some extent in the clinical area.

One way to assist the students to cope with the knowledge component of injections and medications would be to provide them with a handout that they could take with them to use as a handy reference in the clinical area. The use of the IIOS (Intramuscular Injection Observation Sheet) rating scale for IM injections should be slightly modified (to reflect minor alterations in clinical practice in the hospitals used in second year). A number of students used it, especially initially to learn the steps of the procedure and the sequencing of the steps. Faculty reported that the tool was useful in assisting them to provide detailed feedback to the students about their performance. Students could also use it as a guide for self evaluation.

While self-efficacy as measured by Form A did not appear to affect performance of injections, it would still be useful to administer at selected injections to identify which parts of the IM procedure were most troublesome. For some students the area of concern will be in preparing the injection; for others it is the actual giving of the injection that causes concern. If these two groups could be identified early in the learning process appropriate remedial work could be undertaken (the type of practice required by these two groups would be very different).

In relation to the teaching strategies used, the students' responses were generally quite positive. Additional time for the classroom content would be useful. The handout previously mentioned would also facilitate the transfer of information. More time also needs to be provided in the laboratory to practice injecting the meat. In addition, many students expressed a desire to give more injections to each other, making use of additional injection sites. In light of the students' expressed concerns about landmarking for injections, some creative strategies need to be developed for additional practice of this component of the procedure. There is a fine line between making the students cautious and careful about the risks involved, and alarming them to the point that anxiety is increased to a detrimental level.

The use of the video and the experience of injecting a peer seem useful to retain. The video tape should be revised, to delete some of the commentary; in a demonstration such as this students' attention should be drawn to only the most important points. It could be strengthened by including a student as one of the role models.

Students need to be made more aware of the need for extensive practice, both of drawing up medications, and the injecting of them, and be provided with equipment to practice at home. Although this was mentioned in the laboratory session, many students were unaware that they could take equipment home. Some students actually purchased equipment from a drugstore and practiced on a variety of inanimate objects at home.

The giving of injections to patients in the clinical area presents many problems. Often it is not the best situation for students to be trying to learn new skills. The instructors do attempt to keep the learning situation as simple and as predictable as possible. The students expressed concerns about the experience of learning to give injections points to the need for increased sensitivity on the part of the instructor to assist the students to discuss their feelings.

Students are very afraid of making a terrible mistake and instructors may give the impression that making a mistake is not acceptable under any circumstances (Blainey, 1980). This is one of the dilemmas in any practice profession; the student is not allowed to make any mistakes because the safety of the patient is at stake. Mistakes that are made need to be handled carefully in order that the student is not devastated by them. The student can learn that a mistake can be turned into a constructive learning experience.

Implications of the Study for Nursing and for Future Research

Evaluation of Triangulation. Given the lack of knowledge about skill acquisition in nursing, triangulation, or the use of several different methodologies in the study of IM injections was extremely useful. The data obtained through the observations and interviews added to the richness of the findings and led to a greater understanding of the research topic. The investigator was impressed with the willingness of the students to share their feelings and ideas. However, the interviews may have served as a form of intervention, and thereby had a treatment effect on variables such as anxiety, self-esteem, and self-efficacy. This could be seen as a limitation of the study.

The qualitative aspects of this study have been used to illustrate the quantitative measures, as well as to provide a description of the experience of learning to give an intramuscular injection from the perspective of the students. This descriptive material adds to the small body of knowledge currently available about the acquisition of psychomotor skills in nursing.

Implications for Nursing Education. While the results obtained in this study are specific to this particular group of students, they could serve to raise the consciousness of all nursing instructors in appreciating the range of student responses to learning this invasive skill. The findings related to responses are congruent with those found by Field (1981) in her study of students and graduate nurses. For example:

> I am torn between the benefits of the injection and my own fear of pain. As I stand there I experience the pain of past injections I have received and I add this pain to the reality of the now. I am afraid of my hurt and I reflect this on the other. (p. 293)

For most of the students in this present study, having the opportunity to discuss their feelings and concerns about injections was viewed as helpful. One or two students found that talking about injections caused them to think about how they really were feeling and served to increase their apprehension about the procedure.

Based on the study several suggestions regarding the teaching of IM injections can be proposed. Before beginning the teaching of the skill, an opportunity should be provided to allow students to discuss past experiences with injections and what the procedure means to them. This will serve to increase the instructor's sensitivity to "where the students are at".

While with other skills the instructor must provide the "set to learn" or the desire to learn the skill, given the importance of injections in the minds of the students, little needs to be done in terms of motivation. However, the provision of an accurate model of what is to be done is useful at this stage. Videotaped demonstrations are particularly helpful in providing an example that students can watch several times during the learning process. The use of instructors and students as role models can add to the power of the role modeling. The demonstration needs to be simple, with only a few important cues being mentioned. Students' attention must be focused on the procedure rather than on the results. The demonstration would show the procedure from start to finish, and would include a sample of interactions with a "patient". The students should be left with the feeling that it is possible to learn the skill. The observation of the model serves to form a mental imprint in the students' minds and this results in the beginning formation of the motor plan. At this point the learners need to be forced to internalize the plan by focusing on what they will look like while performing the skill and what it will feel like to insert the needle into the muscle.

The learners then require time to attempt the skill. A variety of useful simulations are available. Students need time to "play" at this point until they have the feeling of the wrist action, the force required to insert the needle, how to aspirate, inject the medication, and withdraw the needle. Students are to be encouraged to practice numerous repetitions with the simulations until they feel confident and have gained a feeling of how the skill is to be performed (Pease, 1977). It is important that instructors assist the students in learning how to evaluate and interpret feedback in order to make decisions about the next attempt. The most useful focus of the feedback is on the kinesthetic feelings of the performance which can then be evaluated against the motor plan. Pease (1977) has emphasized that "every result...is the result of performance" and instructors and learners both tend to forget this and act in an emotional way about the results (e.g., "Good, Mary". and "That's better, Susan".) (p. 111). Instead, the learners need to examine the results and determine why the results occurred (what was right or wrong about the performance) (Pease, 1977). The students must then have an opportunity to attempt the skill again. The instructor encourages the students to describe what was right and wrong about the performance, thereby forcing the learner to attend to the feedback.

In the clinical setting the instructor needs to allow more opportunities for the students to focus on the IM procedure and their own feelings and not be expected to also deal with the patients' concerns. Efforts on the part of the instructor to make the clinical situation as stable as possible are useful. Nursing instructors can make use of previously mentioned techniques to assist students to lower anxiety levels and to increase self-esteem.

Implications for Further Research. Given both the qualitative and quantitative results of the study, further research is indicated. Exploration of the experience of learning to give injections needs to be attempted with other baccalaureate, diploma, and college nursing students to more adequately develop the constructs involved. This approach could then be expanded to other professional student groups that also learn to give injections (dentistry, medicine and medical laboratory science). The question to be raised is whether or not other students, giving other types of injections, experience similar feelings and concerns as nursing students do with IM injections. It would also be interesting to compare the teaching strategies used by other professional groups.

The development and evaluation of specific procedures for assisting students to deal with high anxiety and low self-esteem seems like a worthwhile endeavor from the point of view of the individual students involved. Also by teaching nursing students a variety of practical coping techniques they can in turn, teach the technique to patients who may be experiencing anxiety and low self-esteem.

Although the results of the manipulative dexterity tests did not appear to influence early performance, further investigation may be warranted. Perhaps this particular group of students is more or less dextrous than other groups might be. Further assessment of the use of GATB (1970) tests with nursing students, students in other professional disciplines, and with experienced graduate nurses is needed to determine the usefulness of these tests in assessing manipulative dexterity. Other dexterity tests could be examined and tested to determine if any are more sensitive to the types of dexterity required in nursing.

The Dreyfus Model of Skill Acquisition (cited in Benner, 1984) could be used to further identify the progression of skill development (using IM injections as one example) as nurses move through the levels from novice to expert.

The findings of this study with respect to the teaching and learning of intramuscular injections can be considered in light of the broader topic of psychomotor skill learning in nursing. When studies such as that of Boyd and Conrad (1981) have identified that new graduates and even graduates with some work experience evaluated themselves as being unable to perform basic nursing skills to an acceptable competence level, nursing education programs need to be carefully examined with respect to the philosophy regarding the importance of skill acquisition and to the current strategies used in the teaching of psychomotor skills.

In this study an attempt has been made to describe the learning of a complex nursing skill, that of intramuscular injections, from the point of view of a group of baccalaureate nursing students. Some examples of individual experiences have been included. In the teaching of this particular skill it is necessary to keep in mind the way each individual will experience the situation. "Every nurse begins the act of giving an injection with her own past and her own expectations of the future. Each injection is the nurses's own personal situation, unique to her" (Field, 1981, p. 295).

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APPENDIX 1

Informed Consent Form

Title of Project: Psychomotor Skill Acquisition in Nursing: Intramuscular Injections

Investigator:

Rene A. Day, R.N., M.Sc.
Provisional Ph.D. Candidate
Department of Educational Psychology
University of Alberta
5-114G Education North
Edmonton, Alberta

Phone: 432-6430 (for messages)
437-2488 (after 6:00 p.m.)

Purpose of the Study: This project is designed to identify the phases and strategies involved in learning a psychomotor skill (IM injections), as well as factors that may affect the learning and performance.

Procedures:

1. Tests of anxiety, manual dexterity, self-esteem, and self-efficacy at selected intervals.
2. Tape recorded interviews x 3.
3. Observations made during classroom lecture, demonstration, and laboratory practice.
4. Knowledge test.
5. Evaluation of preparing and giving IM injection #2 and #3, and a final injection occurring during the last two weeks of the term.

Time involved: Approximately 90 minutes of out of class time.

Consent: I consent to taking tests of anxiety, manual dexterity, self-esteem, self-efficacy, and knowledge of asepsis and IM injections.

I consent to be interviewed, and to have the interviews tape recorded.

I understand that my name will not be disclosed in any reports, and that at the completion of the project, the audio tapes will be erased.

I am aware that I may withdraw from the study at any time, without penalty. Further, I understand that neither my participation or non-participation in this study, nor my withdrawal from the study, will in any way affect my grade in Nursing 320.

I have had the opportunity to ask questions. My questions (if any) have been satisfactorily answered.

Right Handed ____ Left Handed ____

I.D. #______________________________

Name (print) ______________________

Investigator	Date	Signature	Date
______________	__________	________________	__________
		Witness	Date
		________________	__________

APPENDIX 2

Interview #1

Name________________________________ Date____________________

I.D. #______________________________

1. Have you ever given an IM injection, or any type of injection?
   Yes____ No____

   Description:

2. FINE MOTOR ACTIVITIES

   a. knitting____ crocheting____ needlework____

      sewing____ model building____ playing piano____

      other musical instruments______________________________

      puzzles____ typing____ other_________________________

   b. Amount of time involved on regular basis?

   c. Degree of proficiency - level attained?

3. GROSS MOTOR ACTIVITIES

   a. baseball____ basketball____ farm work____

      hockey____ racquet sports____

      eg.____

      swimming____ volleyball____ other____________________

      ____

   b. Amount of time involved on a regular basis?

c. Degree of proficiency - level attained?

4. SELF DESCRIPTION OF MANUAL DEXTERITY AND COORDINATION

a. In relation to manual dexterity and coordination, how would you describe yourself (in a word or phrase)?

b. How would you rate yourself - UNSILLFUL - SKILLFUL?

1	2	3	4	5
unskillful				skillful

AND

1	2	3	4	5
not at all	somewhat	moderately	very good	extremely good

c. Comments, examples:

SELECT A PSYCHOMOTOR SKILL LEARNED IN THE PAST

Example ____

5. Recall the PHASES in past psychomotor skill learning. For example, learning a poem: beginning, middle, late phases.

6. Identify LEARNING STRATEGIES used in the past. (eg. learning a poem)

7. Self description of the usual DEGREE OF ANXIETY experienced when faced with a new learning task.

1	2	3	4
not at all	somewhat	moderately so	very much so

8. Self description of ANXIETY re: IM INJECTIONS

Circle the number which best indicates the level of anxiety anticipated during each of the listed steps of the intramuscular injection procedure.

	None At All	Somewhat	Moderately So	Very Much So
1. Calculating the dosage	1	2	3	4
2. Drawing up the medication into the syringe	1	2	3	4
3. Preparing the patient for the injection	1	2	3	4
4. Landmarking (finding) the appropriate site for the injection	1	2	3	4
5. Placing the needle into the patient	1	2	3	4
6. Injecting the medication	1	2	3	4
7. Preparing and giving the injection WITHOUT supervision	1	2	3	4

9. Self description of LEVEL OF SELF-ESTEEM generally (how they feel about themselves).

1 2 3 4 5
low high

10. Self description of LEVEL OF SELF-ESTEEM in relation to IM injections.

1 2 3 4 5
low high

11. SELF-EFFICACY - generally able to do most things at university, in nursing, in the past.

unable 1 2 3 4 5 6 7 8 9 10
to do low high

b. Comments

12. SELF-EFFICACY in relation to IM INJECTIONS.

On the following rating scale, circle the number that best describes your own assessment of your ability to perform each task, at this time. If you are unable to do any of the tasks, mark an "X" under that column.

	unable to do	low									high
1. Calculating the dosage	_____	1	2	3	4	5	6	7	8	9	10
2. Drawing up the medication into the syringe	_____	1	2	3	4	5	6	7	8	9	10
3. Preparing the patient for the injection	_____	1	2	3	4	5	6	7	8	9	10
4. Landmarking (finding) the appropriate site for the injection	_____	1	2	3	4	5	6	7	8	9	10
5. Placing the needle into the patient	_____	1	2	3	4	5	6	7	8	9	10
6. Injecting the medication	_____	1	2	3	4	5	6	7	8	9	10
7. Preparing and giving the injection WITHOUT supervision	_____	1	2	3	4	5	6	7	8	9	10

b. OUTCOME EXPECTATIONS?

c. Comments

13. Any FEELINGS, CONCERNS, about giving injections? Personal experience with receiving injections? Have you seen any IM injections being given? Is the skill of IM injections any different from the other skills you are learning this year?

APPENDIX 3

Interview #2

Name ____________________ Date ____________________

I.D. #____________________

1. Any thoughts from the last interview?

2. Comments on Jan. 24th experience? - Injection Day.

    a. Class?

    b. Lab - preparing and injecting the meat?

    c. Lab - video?

    d. Lab - injecting a peer?

3. Comments on Injections #1, 2, 3, with patients?

    a. Type/age of patient

    b. Reaction to age of patient

c. Parts of the procedure

d. Reaction of patient

e. Reaction of student

f. Reaction of instructor

4. Phases of learning IM injections?

5. Strategies used in learning IM injections?

APPENDIX 4

Interview #3

Name______________________________ Date__________________

I.D.#_______________ TOTAL # of IM's given_________

SITES used and # of each______

1. Summary of psychomotor skill learning:

   a. What was the hardest part of IM procedure to learn?

   b. What was the easiest part of IM procedure to learn?

   c. What was the most useful strategy in learning IM's?

   d. What was the least helpful strategy in learning IM's?

2. CONFIDENCE in preparing and administering IM injections on your own:

   a. PREPARING:

1	2	3	4	5	6	7	8	9	10
low									high

   b. ADMINISTERING:

1	2	3	4	5	6	7	8	9	10
low									high

   c. COMMENTS:

3. Circle the number that best describes how skillful you are at preparing and administering IM injections.

   a. PREPARING:

1	2	3	4	5
unskillful				skillful

1	2	3	4	5
not at all	somewhat	moderately	very good	extremely good

b. ADMINISTERING:

1	2	3	4	5
unskillful				skillful

1	2	3	4	5
not at all	somewhat	moderately	very good	extremely good

c. COMMENTS:

4. Circle the number that best describes the level of anxiety experienced during each of the listed steps of the IM injection procedure.

a. Calculating the dosage	1	2	3	4
b. Drawing up the medication into they syringe	1	2	3	4
c. Preparing the patient for the injection	1	2	3	4
d. Landmarking the appropriate site for the injection	1	2	3	4
e. Placing the needle into the patient	1	2	3	4
f. Injecting the medication	1	2	3	4
g. Preparing and giving the injection WITHOUT supervision	1	2	3	4

5. Self description of LEVEL OF SELF-ESTEEM GENERALLY.

1	2	3	4	5
low				high

6. Self description of LEVEL OF SELF-ESTEEM in relation to IM injections.

1	2	3	4	5
low				high

7. Self description of SELF-EFFICACY (able to do most things in nursing).

unable	1	2	3	4	5	6	7	8	9	10
to do	low									high

8. Self description of SELF-EFFICACY in relation to IM injections.

a. On the following rating scale, circle the number that best describes your own assessment of your ability to perform each task, at this time. If you are unable to do any of the tasks, mark an "x" under that column.

	unable to do	low									high
a. Calculating the dosage	_____	1	2	3	4	5	6	7	8	9	10
b. Drawing up the medication into the syringe	_____	1	2	3	4	5	6	7	8	9	10
c. Preparing the patient for the injection	_____	1	2	3	4	5	6	7	8	9	10
d. Landmarking the appropriate site for the injection	_____	1	2	3	4	5	6	7	8	9	10
e. Placing the needle into the patient	_____	1	2	3	4	5	6	7	8	9	10
f. Injecting the medication	_____	1	2	3	4	5	6	7	8	9	10
g. Preparing and giving the injection WITH-OUT supervision	_____	1	2	3	4	5	6	7	8	9	10

b. OUTCOME EXPECTATIONS

9. Differences between giving first IM to a CHILD versus ADULT?

10. Summary (any feelings, concerns about IM injections?)

APPENDIX 5

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Self-Evaluation Questionnaire

Developed by C.D. Spielberger, R.L. Gorsuch and R. Lushene (1970) Manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press.

STAI Form X-1

APPENDIX 6

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Self-Evaluation Questionnaire

Developed by C.D. Spielberger, R.L. Gorsuch and R. Lushene (1970) Manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press.

STAI Form X-2

APPENDIX 7

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Self-Evaluation Questionnaire

Developed by C.D. Spielberger, R.L. Gorsuch and R. Lushene (1970) Manual for the State-Trait Anxiety Inventory. Palo Alto: Consulting Psychologists Press.

STAI Form X-1 adapted for use with injections

APPENDIX 8

PLEASE COMPLETE THIS FORM IMMEDIATELY AFTER YOU HAVE GIVEN AN INTRAMUSCULAR INJECTION.

FORM B
IM Injections

Name________________________ Date__________________

I.D. #_______________________

Circle the number which best indicates the level of anxiety experienced during each of the listed steps of the intramuscular injection procedure.

	Not At All	Somewhat	Moderately So	Very Much So
1. Calculating the dosage	1	2	3	4
2. Drawing up the medication into the syringe	1	2	3	4
3. Preparing the patient for the injection	1	2	3	4
4. Landmarking the appropriate site for the injection	1	2	3	4
5. Placing the needle into the patient	1	2	3	4
6. Injecting the medication	1	2	3	4
7. Preparing and giving the injection WITHOUT supervision	1	2	3	4

APPENDIX 9

KNOWLEDGE TEST for the Research Project

Psychomotor Skill Acquisition in Nursing: Intramuscular Injections

INSTRUCTIONS:

1. Please answer all questions on the computer answer sheet.
2. The answer sheet may be filled out in pencil or pen.
3. Place your name and I.D.# on the computer answer sheet.
4. Please do not write on the examination booklet.

Please be assured that your score on the test will NOT be counted towards your grade in Nursing 320.

This test was developed by:

Sandra Boyd
Elaine McKiel
Jaci Murphy

Questions 1 and 2 pertain to the following medication card.

Mr. James Orem
621986
61 Years Dr. Em

Gravol 50 mg. I.M. p.r.n.

1. The information on this medication card is:

    1. complete for drug administration
    2. lacks information about the drug
    3. lacks information about the frequency of administration
    4. lacks information about the route of administration

2. Given that the information on this medication card has been transcribed correctly and completely from the patient's chart, the "rights" which are demonstrated include:

    a. right drug
    b. right dose
    c. right route
    d. right doctor

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

3. The "right technique" in administering an intramuscular medication is demonstrated by:

    1. mapping the correct site for an injection
    2. teaching the patient about the purpose of the drug
    3. checking the amount of drug in the syringe with the medication card
    4. completing 3 identification checks prior to giving the drug

4. To administer this drug to Mr. Orem who is an average sized adult, you would choose a needle which is:

    a. number 22 gauge
    b. number 25 gauge
    c. 5/8 inch long
    d. 1 1/2 inches long

        1. a, c
        2. a, d
        3. b, c
        4. b, d

5. Additional supplies necessary for this injection would include:

   a. alcohol swabs
   b. a medication tray
   c. a 3 mL syringe
   d. a bandaid

      1. a, b, c
      2. a, c
      3. b, d
      4. d only
      5. all are correct

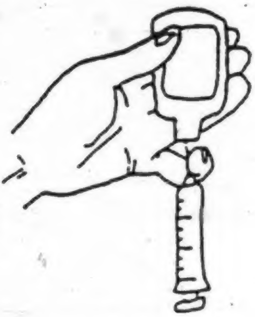
6. To prepare an intramuscular injection from a multi-dose medication vial, the correct sequences of steps is to:

   a. withdraw the medication from the vial
   b. eject any air from the medication in the syringe
   c. cleanse the top of the vial with an antiseptic swab
   d. inject air into the vial which is equal to the volume of drug to be given

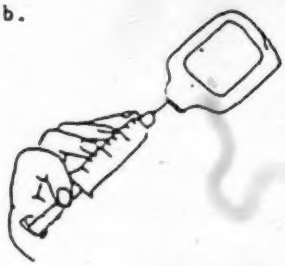
      1. c, d, a, b
      2. d, c, a, b
      3. c, a, d, b
      4. b, c, d, a

7. Of the following pictures, aseptic technique is demonstrated in:

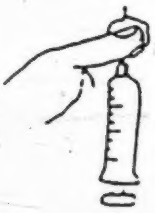
a.



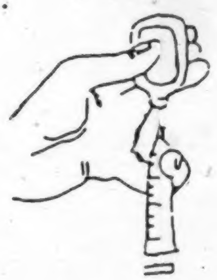
b.



c.



d.



   1. a, b, c
   2. a, c
   3. b, d
   4. d only
   5. all are correct

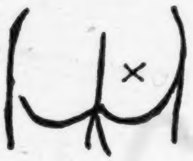
8. Which of the following muscles can be used for an intramuscular injection?

   a. deltoid
   b. vastus lateralis
   c. gluteus medius
   d. latissimus dorsi

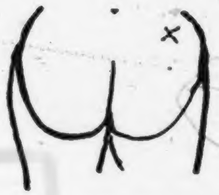
      1. a, b, c
      2. a, c
      3. b, d
      4. d only
      5. all are correct

9. Select the drawing which demonstrates a correct site for an intramuscular injection.

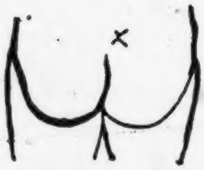
1.



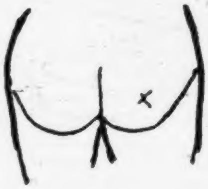
2.



3.



4.



10. The main reason for selecting the correct site for an intramuscular injection is to:

    1. avoid puncturing a blood vessel
    2. avoid injecting into adipose tissue
    3. inject into the thickest portion of the muscle
    4. avoid touching the sciatic nerve

11. Supportive care for Mr. Orem who is apprehensive about receiving an intramuscular injection could be provided by:

    a. drawing the curtains around his bed prior to giving the medication
    b. explaining the reason for administering the drug intramuscularly
    c. exposing the injection area of his body only
    d. describing all the side effects of the medication

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

12. Information about a medication should be given to Mr. Orem when:

    1. he requests the information
    2. the physician asks that Mr. Orem be informed
    3. it is known that he will be taking the medication at home
    4. he appears ready to learn about the medication

13. Trauma due to an intramuscular injection can be diminished by:

    a. inserting the needle at a 45 degree angle
    b. applying pressure to the injection site after withdrawing the needle
    c. injecting the solution quickly
    d. having Mr. Orem wiggle his toes prior to inserting the needle

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

14. Following administration of the intramuscular injection to Mr. Orem, important nursing activities include:

    a. ensuring a comfortable patient position
    b. observing for medication effects
    c. eliciting further patient questions
    d. inspecting for the injection site

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

15. Used injection equipment and supplies should be handled correctly to avoid:

    a. mechanical injury
    b. use by unauthorized persons
    c. cross-infection
    d. medication errors

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

16. Appropriate charting of the intramuscular injection for Mr. Orem would be:

    a. Feb. 17 1230 Gravol 50 mg. I.M. given for nausea.
       S. Smith, B.Sc.N. student, U. of A.
    b. Feb. 17 1230 Gravol 50 mg. (L) gluteal area given for nausea.
       S. Smith, B.Sc.N. student, U. of A.
    c. Feb. 17 1230 Gravol 50 mg. I.M. (L) hip given for nausea.
       S. Smith, B.Sc.N. student, U. of A.
    d. Feb. 17 1230 Gravol 50 mg. I.M. (L) gluteus medius given for nausea.
       S. Smith, B.Sc.N. student, U. of A.

        1. a, b, c
        2. a, c
        3. b, d
        4. d only
        5. all are correct

APPENDIX 10

Intramuscular Injection Observation Sheet

I.D. #__________ NAME:____________________ DATE:________________ INJECTION #__________

NAME OF RATER:____________________ PREPARATION BEGINNING TIME:________________ ENDING TIME:__________

ADMINISTRATION BEGINNING TIME:________________ ENDING TIME:__________

		YES	NO	COMMENTS
Preparation (1-18)	1. Check medication card with chart or doctor's order sheet.			
	2. Checks time when last dose given.			
	3. Washes hands.			
	4. Cleans tray.			
	5. Assembles materials: tray, alcohol, swabs, needle, syringe, medication, card or chart			
	6. Selects appropriate size needle and syringe.			
	7. Attaches needle to syringe without contamination.			
	8. Checks medication with card or chart.			
	9. Cleanses top of vial with antiseptic (if applicable).			
	10. Injects appropriate amount of air into multiple dose vial (if applicable).			
	11. Removes medication lodged in head of ampule (if applicable).			
	12. Opens ampule correctly.			
	13. Fills syringe and gets rid of air bubbles.			
	14. Measures dose accurately.			
	15. Avoids contamination of syringe plunger.			
	16. Protects needle from contamination.			
	17. Checks amount in syringe with medication label and card or chart.			
	18. Places ampule or vial in appropriate place.			

		YES	NO	COMMENTS
	19. Takes all necessary equipment and med card (or chart) to bedside.			
	20. Asks patient to identify himself.			
	21. Checks I.D. band with med card or chart.			
	22. Explains purpose of injection to patient.			
	23. Provides privacy for patient by drawing curtains and avoiding unnecessary exposure.			
Administration (24-37)	24. Maps appropriate site, using one method correctly.			
	25. Cleanses site with firm pressure and circular motion from center out.			
	26. Maintains swab in accessible position.			
	27. Grasps skin in preparation for injection (either bunching or spreading).			
	28. Facilitates relaxation of muscles by patient.			
	29. Informs patient that she is about to give injection.			
	30. Inserts needle at 90°.			
	31. Inserts needle quickly.			
	32. Avoids contamination of needle during injection.			
	33. Pulls back on plunger.			
	34. Maintains control of syringe.			
	35. (If no blood appears) inject medication slowly.			
	36. Removes needle at insertion angle.			
	37. Massages site with swab.			
-----------				
	38. Leaves patient comfortable.			
Equipment & Recording (39-43)	39. Disposes of equipment correctly.			
	40. Washes hands.			
	41. Uses card or chart to record procedure.			
	42. Charts procedure accurately (time, drug, dose, route, site, purpose, signature, B.Sc.N. student U. of A.)			
	43. Replaces card into correct slot.			

APPENDIX 11

Scoring Manual for Intramuscular Injection Observation Sheet

Developed by Boyd, McKeil & Murphy (1983)
Adapted for use by R. Day, 1985

1. Check medication card with chart or doctor's order sheet.

CHECK If the student:

1. Yes - checks the card with the physician's order
- checks the physician's order (in situations where no card is used)

No - if the above step is omitted

2. Checks time when last dose given.

2. Yes - checks the Progress Notes for the last dose given
- if this is a one dose injection it is still necessary to check the Progress Notes

No - if the Progress Notes are NOT checked

3. Washes hands.

3. Yes - washes her hands before preparing injection

No - does not wash her hands

4. Cleans tray (if available).

4. Yes - washes the tray or cleans it with an alcohol swab

No - does not cleanse tray

5. Assembles materials: tray, alcohol, swabs, needle, syringe, medication, card or chart

    5. Yes - organizes all of the equipment needed: tray, alcohol swabs, syringe, medication, card or chart

    No - misses one of the pieces of equipment
    *Note: this is an organizational step

6. Selects appropriate size needle and syringe.

    6. Yes - selects a syringe size appropriate to the amount of drug
    - selects a #22 - 1.5" needle which is considered standard
    - selects a #22 - 1" needle if the patient is thin or small in size (needle appropriate for patient)

    No - selects a needle and syring other than indicated above (one that is not appropriate for patient)

7. Attaches needle to syringe without contamination.

CHECK If student:

    7. Yes - leaves the plastic cap on the syringe until after the needle is opened
    - touches the hub only minimally, to secure the needle and/or remove the cap

    No - exposes the tip of the syringe before she is ready to attach the needle
    - touches the needle hub grossly
    - touches the needle in any way
    - places the syringe and needle on the tray without the protective cap
    - breaks principles of asepsis in any other way

8. Checks medication with card or chart.

    8. Yes - checks the medication label, for right dose and drug, with the card or chart

    No - does not make this check

9. Cleanses top of vial with antiseptic (if applicable).

    9. Yes - cleanses the top of the vial with an alcohol swab
        - maintains sterility after removing the protective cover on the vial, but does not cleanse with alcohol

    No - omits the above step

10. Injects appropriate amount of air into multiple dose vial (if applicable).

    10. Yes - injects an amount of air equal to the amount of drug to be removed, into the vial

    No - omits this step
        - injects an amount of air into the vial, not equal to the amount of drug to be withdrawn

11. Removes medication lodged in head of ampule (if applicable).

    11. Yes - removes medication lodged in the head of the ampule using any method

    No - does not remove drug from the head of ampule

12. Opens ampule correctly.

    12. Yes - opens the ampule away from her body so as not to contaminate the top of the ampule
        - protects her hands by wrapping the ampule with something clean or sterile
        - does not protect her hands
        - uses an ampule opener
        - files or does not file the ampule

    No - contaminates the ampule while opening it

13. Fills syringe and gets rid of air bubbles.

CHECK If student:

13. Yes - removes the air bubbles by:
    - drawing back on the plunger and ejecting air space
    - tapping the syringe barrel with her finger
    - tapping with a pen is accepted but not encouraged.

No - does not remove air bubbles or air space from the syringe

14. Measures dose accurately.

14. Yes - draws amount of medication into the syringe equal to the amount ordered

No - draws an incorrect amount of drug into the syringe (either too much or too little)

15. Avoids contamination of syringe plunger.

15. Yes - touches only the barrel, the tip of the plunger and that part of the plunger visible before the plunger is drawn back

No - touches the part of the plunger that goes inside the barrel

16. Protects needle from contamination.

16. Yes - does not contaminate the needle in any way other than accepted in step #7

No - contaminates needle by touching with fingers, an object, placing it on the tray without the protective cover, or any other way

17. Checks amount in syringe with medication label and card or chart.

    17. Yes - rechecks the amount of drug in the syring, with the card or chart, before discarding the vial or ampule

        No - discards the empty ampule or vial without making this check
        - replaces the multidose vial without making this check

18. Places ampule or vial in appropriate place.

    18. Yes - places the multidose vial in the fridge
        - discards used vials and ampules in the container for glass

        No - throws used ampules and vials or partly full vials, in the regular garbage can
        - leaves the vial or ampule on the counter

19. Takes all necessary equipment and med card (or chart) to bedside.

    19. Yes - does not need to return to the med. room for one of the articles listed in step #5

        No - forgets one or more articles

20. Asks patient to identify himself.

    20. Yes - asks the patient to state his/her full name

        No - does not ask the patient to identify himself

21. Checks I.D. band with med card or chart.

    CHECK If student:

    21. Yes - checks the I.D. bracelet with the card by aligning them and assuring they are the same
        - checks the I.D. bracelet against the patient's identification addressographed on the Doctor's order sheet, and assuring they are the same

        No - omits this check

22. Explains purpose of injection to patient.

22. Yes - explains the purpose of the injection in one sentence or more

No - makes no explanation to the patient

23. Provides privacy for patient by drawing curtains and avoiding unnecessary exposure.

23. Yes - draws the curtains
- exposes the site enough to visualize the site adequately

No - does not draw curtains
- exposes patient excessively

24. Maps appropriate site, using one method correctly.

24. Yes - maps the site using at least one method correctly

No - does not map
- maps incorrectly

25. Cleanses site with firm pressure and circular motion from center out.

25. Yes - cleanses site with a firm pressure and circular motion from centre out

No - does not cleanse the site

26. Maintains swab in accessible position.

26. Yes - holds swab between fingers
- places swab on buttocks
- keeps swab within easy reach

No - does not place swab within easy reach before injecting solution

27. Grasps skin in preparation for injection (either bunching or spreading).

27. Yes - spreads skin for average or heavy patient
- bunches skin for thin person

No - does not do the above

28. Facilitates relaxation of muscles by patient.

28. Yes - asking patient to turn toes inward and/or
- asking patient to take a deep breath and/or
- asking patient to perform another relaxation method (e.g., wiggling toes)

No - does not facilitate relaxation

29. Informs patient that she is about to give injection.

CHECK If student:

29. Yes - indicates to the patient, in some way, that she is about to give the injection

No - injects without warning the patient

30. Inserts needle at 90°.

30. Yes - inserts the needle at a 90° angle

No - inserts the needle at an angle other than 90°

31. Inserts needle quickly.

31. Yes - injects with one swift movement

No - fails to puncture skin
- jabs more than once
- does not inject quickly

32. Avoids contamination of needle during injection.

32. Yes - does not contaminate needle

No - contaminates needle by touching it, puncturing twice or any other way

33. Pulls back on plunger.

    33. Yes - aspirates by pulling on plunger before injecting drug

        No - does not pull back on plunger

34. Maintains control of syringe.

    34. Yes - controls syringe and prevents it from wobbling

        No - allows syringe to wobble

35. (If no blood appears) injects medication slowly.

    35. Yes - assures that there is no blood in the syringe
        - injects drug slowly but evenly

        No - injects blood into patient
        - injects quickly
        - injects unevenly

36. Removes needle at insertion angle.

    36. Yes - removes needle at the same angle (90°) as insertion

        No - removes needle at any other angle

37. Massages site with swab.

    37. Yes - massages site with swab, or applies pressure, or gently wipes the site, depending on drug and the situation

        No - does not massage, or apply pressure, or wipe the site

38. Leaves patient comfortable.

CHECK If student:

38. Yes - leaves the patient comfortable by covering, re-positioning, opening curtains, rolling up bed or another means

No - leaves the room without providing comfort measures

39. Disposes of equipment correctly.

39. Yes - places the needle and syringe in the "Shaprs" container or other designated location
- cleanses the tray, if used, with water or an alcohol swab
- returns the tray, if used, to appropriate place

No - neglects to do any of the above

40. Washes hands.

40. Yes - washes her hands

No - does not wash her hands

41. Uses card or chart to record procedure.

41. Yes - records injection using care of doctor's order sheet
No - does not use card or chart

42. Charts procedure accurately (time, drug, dose, route, site, purpose, signature, B.Sc.N. student U. of A.)

42. Yes - records the procedure according to type of procedure and policy of unit
- indicates time, drug, dose, route, site, purpose, signature and B.Sc.N. student U. of A.

No - records on wrong sheet
- omits: time, drug, dose, route, site, purpose, signature or B.Sc.N. student U. of A. (omission of one component constitutes a No)

43. Replaces card into correct slot.

APPENDIX 12

Form C
IM Injections

INSTRUCTORS: Please complete this form AFTER the student has completed her final injection.

Name________________________________ Date________________

Instructor's Name_________________ Injection #_________

1. Considering the student's performance at this point in time, would you allow her to give further IM injections on her own, WITHOUT supervision?

2. If NO, please check all areas of concern.

_____ a. calculating the dose
_____ b. drawing up the medication into the syringe
_____ c. identifying the patient
_____ d. preparing the patient for the injection
_____ e. landmarking the appropriate site
_____ f. placing the needle into the patient (includes aspirating)
_____ g. injecting the medication
_____ h. withdrawing the needle
_____ i. leaving the patient comfortable
_____ j. disposing of equipment
_____ k. charting the medication in appropriate places
_____ l. other____

____

3. Circle the number on both parts A and B that best describes how SKILLFULLY the student prepared and administered this final injection.

A.	1 unskillful	2	3	4	5 skillful
B.	1 not at all	2 somewhat	3 moderately	4 very good	5 extremely good

C. Comments:

4. Circle the number that best describes your assessment of the student's level of knowledge about injections.

A.	1	2	3	4	5
	none	some	moderate	very good	extremely good

B. Comments:

5. General Comments:

APPENDIX 13

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Culture-Free SEI Form AD

Developed by Battle, J. (1981). The Culture-Free Self-Esteem Inventory for Adults. Seattle: Special Child Publications.

APPENDIX 14

PLEASE COMPLETE THIS FORM PRIOR TO PREPARING AND GIVING AN INTRAMUSCULAR INJECTION.

FORM A
IM Injections

Name________________________________ Date_________________________

I.D. #______________________________ Injection #_________________

On the following rating scale, circle the number that best describes your own assessment of your ability to perform each task, at this time. If you are unable to do any of the tasks, mark an "X" under that column.

	unable to do	low 1	2	3	4	5	6	7	8	9	high 10
1. Calculating the dosage	_____	1	2	3	4	5	6	7	8	9	10
2. Drawing up the medication into the syringe	_____	1	2	3	4	5	6	7	8	9	10
3. Preparing the patient for the injection	_____	1	2	3	4	5	6	7	8	9	10
4. Landmarking the appropriate site for the injection	_____	1	2	3	4	5	6	7	8	9	10
5. Placing the needle into the patient	_____	1	2	3	4	5	6	7	8	9	10
6. Injecting the medication	_____	1	2	3	4	5	6	7	8	9	10
7. Preparing and giving the injection WITHOUT supervision	_____	1	2	3	4	5	6	7	8	9	10

APPENDIX 15

t-test Results of Age (Group 1 - age 20 and below; Group 2 - over age 20) Manipulative Dexterity Pre-tests

GATB Manipulative Dexterity Tests	Number of Cases	Mean	t Value**	Degrees** of Freedom	2-tail* Probability
Coordination	Group 1 - 38 Group 2 - 10	108.84 108.90	-0.01	46	0.99
Place	Group 1 - 38 Group 2 - 10	92.97 100.20	-2.90	46	0.006*
Turn	Group 1 - 38 Group 2 - 10	105.39 112.60	-2.27	46	0.022*
Manual Dexterity (mean of place and turn)	Group 1 - 38 Group 2 - 10	99.18 106.40	-2.96	46	0.005*
Assemble	Group 1 - 38 Group 2 - 10	29.21 31.30	-1.48	46	0.145
Disassemble	Group 1 - 38 Group 2 - 10	31.63 34.00	-2.18	46	0.034*
Finger Dexterity (mean of assemble and disassemble)	Group 1 - 38 Group 2 - 10	30.42 32.65	-2.14	46	0.038*

*Indicates significance at 0.05 level.
**Indicates pooled variance estimate.

APPENDIX 16

Anxiety Responses on Seven Components of the I.M. Procedure
Laboratory Injection (Form B)

		Frequency of Response and Percentage				Total
Components		1	2	3	4	
		Not at All	Somewhat	Moderately So	Very much So	
Calculating Dose	f	18	15	12	2	47*
	%	38.30	31.91	25.53	4.26	100
Drawing up Medication	f	17	18	8	4	47
	%	36.17	38.30	17.02	8.51	100
Preparing the Patient	f	25	9	10	3	47
	%	53.19	19.15	21.28	6.38	100
Landmarking	f	4	26	12	5	47
	%	8.51	55.32	25.53	10.64	100
Place Needle into Patient	f	9	11	20	7	47
	%	19.15	23.40	42.55	14.89	99.99
Injecting Medication	f	17	14	11	5	47
	%	36.17	29.79	23.40	10.64	100
Giving without Supervision	f	2	17	21	7	47
	%	4.26	36.17	44.68	14.89	100

*One form not completed.

APPENDIX 17

Anxiety Responses on Seven Components of the I.M. Procedure
Injection #2 (Form B)

		Frequency of Responses and Percentage				Tottal
Components		1	2	3	4	
		Not At All	Somewhat	Moderately So	Very Much So	
Calculating Dose	f	24	17	5	1	477*
	%	51.06	36.17	10.64	2.13	1000
Drawing up Medication	f	15	19	10	3	477
	%	31.91	40.43	21.28	6.38	1000
Preparing the Patient	f	17	19	10	1	477
	%	36.17	40.43	21.28	2.13	1000
Landmarking	f	12	22	10	3	477
	%	25.53	46.81	21.28	6.38	1000
Place Needle into Patient	f	16	13	12	6	477
	%	34.04	27.66	25.53	12.77	1000
Injecting Medication	f	24	17	3	2	466**
	%	52.17	39.96	6.52	4.35	1000
Giving without Supervision	f	5	16	19	7	477
	%	10.64	34.04	40.43	14.89	1000

*One form not completed.
**One section not completed.

APPENDIX 18

**Anxiety Responses on Seven Components of the I.M. Procedure
Injection #3 (Form B)**

Components		Frequency of Responses and Percentage 1	2	3	4	Total
		Not At All	Somewhat	Moderately So	Very Much So	
Calculating Dosage	f %	30 62.50	13 27.08	4 8.33	1 2.08	48 99.99
Drawing up Medication	f %	23 47.92	18 37.50	5 10.42	2 4.17	48 100.01
Preparing the Patient	f %	14 29.17	27 56.25	6 12.50	1 2.08	48 100.00
Landmarking	f %	12 25.00	20 41.67	14 29.17	2 4.17	48 100.01
Place Needle into Patient	f %	18 37.50	21 43.75	5 10.42	4 8.33	48 100.00
Injecting Medication	f %	28 58.33	15 31.25	1 2.08	4 8.33	48 99.99
Giving without Supervision	f %	4 8.51	20 42.55	16 34.04	7 14.89	47* 99.99

*One form not completed.

APPENDIX 19

Anxiety Responses on Seven Components of the I.M. Procedure
Final Injection (Form B)

		Frequency of Responses and Percentage				Total
Components		1	2	3	4	
		Not At All	Somewhat	Moderately So	Very Much So	
Calculating Dose	f	29	14	2	1	
	%	63.04	30.43	4.35	2.17	46*
Drawing up Medication	f	23	19	3	1	
	%	50.00	41.30	6.52	2.17	46
Preparing the Patient	f	21	18	6	0	
	%	45.65	39.13	13.04	0	46
Landmarking	f	10	24	12	0	
	%	21.74	52.17	26.09	0	46
Place Needle into Patient	f	26	12	6	2	
	%	56.52	26.07	13.04	4.35	46
Injecting Medication	f	33	9	3	1	
	%	71.74	19.57	6.52	2.17	46
Giving without Supervision	f	12	18	15	1	
	%	26.04	39.13	32.61	2.17	46

*Two students failed Nursing 320.

APPENDIX 20

t-test Results Comparing High and Low Self-Efficacy with Performance on Three Injections

	Level of Self Efficacy	Mean	S.D.	F-Value	Probability
Injection #2					
Preparation Time (in minutes)	High Low	6.25 7.25	2.05 3.05	2.21	0.024
Administratation Time (in minutes)	High Low	3.18 4.75	1.66 2.17	1.72	0.042
Preparation Score (in percent)	High Low	84.00 90.31	12.24 5.07	5.83	0.001*
Administratration Score (in percent)	High Low	81.56 84.50	11.26 9.29	1.47	0.0465
Equipment & Recording Score (in percent)	High Low	81.13 84.00	16.02 10.81	2.20	0.139
Total Score (in percent)	High Low	82.31 86.88	8.48 5.88	2.08	0.167
Injection #3					
Preparation Time (in minutes)	HIgh Low	6.50 7.00	2.84 3.34	1.39	0.634
Administration Time (in minutes)	High Low	4.46 4.36	5.06 2.82	3.22	0.046*
Preparation Score (in percent)	High Low	88.94 90.93	10.74 10.08	1.13	0.820

	Level of Self-Efficacy	Mean	S.D.	F-Value	Probability
Administration Score (in percent)	High Low	87.59 88.60	7.05 5.50	1.64	0.358
Equipment & Recording Score (in percent)	High Low	85.53 86.47	12.53 14.44	1.33	0.580
Total Score (in percent)	High Low	87.82 88.87	4.99 5.90	1.40	0.515
Final Injection					
Preparation Time (in minutes)	High Low	6.67 5.67	3.94 2.89	1.58	0.364
Administration Time in minutes)	High Low	2.73 2.00	1.74 1.03	2.90	0.040*
Preparation Score (in percent)	High Low	93.33 94.47	8.06 5.41	2.22	0.113
Administrattion Score (in percent)	High Low	88.60 90.53	6.28 7.14	1.29	0.633
Equipment & Recording (in percent)	High Low	76.07 78.42	22.48 22.95	1.04	0.952
Total Score (in percent)	High Low	88.87 90.58	5.04 6.32	1.57	0.0395

*significant at 0.05 level

APPENDIX 21

Self-Efficacy on Seven Components of the I.M. Procedure Prior to Laboratory Injection (Form A)

		Scales (1-10) Frequencies and Percentages										
Components	Unable To Do	Low 1	2	3	4	5	6	7	8	9	High 10	Cases
Calculating Dose	f	0	0	0	1	1	5	20	10	6	4	47*
	%	0	0	0	2.13	2.13	10.64	42.55	21.28	12.77	8.51	
Drawing up Medication	f	0	0	0	1	4	5	12	11	6	8	47
	%	0	0	0	2.13	8.51	10.64	25.53	23.40	12.77	17.02	
Preparing the Patient	f	0	0	0	4	6	7	17	8	3	2	47
	%	0	0	0	8.51	12.77	14.89	36.17	17.02	6.38	4.26	
Landmarking	f	0	2	0	5	5	15	11	6	3	0	47
	%	0	4.26	0	10.64	10.64	31.91	23.40	12.77	6.38	0	
Placing Needle into Patient	f	1	1	1	10	7	10	8	4	3	2	47
	%	2.13	2.13	2.13	21.28	14.89	21.28	17.02	8.51	6.38	4.26	
Injecting Medication	f	0	1	0	4	5	6	7	13	8	3	47
	%	0	2.13	0	8.51	10.64	12.77	14.89	27.66	17.02	6.38	
Giving Without Supervision	f	5	1	8	6	8	6	5	4	1	1	47
	%	10.64	2.13	17.02	12.77	17.02	12.77	10.64	8.51	2.13	2.13	

*Missing Data: One not completed.

APPENDIX 22

Self-Efficacy Scores on Seven Components at the I.M. Procedure
Prior to Injection #2 (Form A)

			Scales (1-10) Frequencies and Percentages									
Components	Unable To Do		Low 1	2	3	4	5	6	7	8	9	High 10	Cases
Calculating Dose		f	0	0	0	1	3	4	8	13	9	10	48
		%	0	0	0	2.08	6.25	8.33	16.67	27.08	18.75	20.83	
Drawing up Medication		f	0	0	0	1	4	5	9	12	11	6	48
		%	0	0	0	2.08	8.38	10.42	18.75	25.00	22.92	12.50	
Preparing the Patient		f	0	0	1	1	3	5	17	9	6	6	48
		%	0	0	2.08	2.08	6.25	10.42	35.47	18.75	12.50	12.50	
Landmarking		f	1	0	0	2	4	10	17	8	4	2	48
		%	2.08	0	0	4.17	8.33	20.83	35.47	16.67	8.33	4.17	
Placing Needle into Patient		f	0	1	0	3	1	6	12	14	6	4	48
		%	0	2.08	0	6.38	2.08	12.77	25.53	29.79	12.77	8.51	
Injecting Medication		f	0	0	1	1	1	3	11	17	10	4	48
		%	0	0	2.08	2.08	2.08	6.25	22.92	35.42	20.83	8.33	
Giving Without Supervision		f	1	1	2	6	6	8	13	5	4	1	48
		%	2.08	2.08	4.17	12.50	12.50	16.67	27.08	10.42	8.33	2.08	

APPENDIX 23

Self-Efficacy on Seven Components of the I.M. Procedure
Prior to Injection #3 (Form A)

			Scales (1-10) Frequencies and Percentages									
			Low								High	
Components	Unable To Do		1	2	3	4	5	6	7	8	9	10	Cases
Calculating Dose		f	0	0	1	0	2	2	11	10	10	11	48
		%	0	0	2.08	0	4.17	4.17	22.92	20.83	20.83	22.9	
Drawing up Medication		f	0	0	0	2	2	3	9	13	7	12	48
		%	0	0	0	4.17	4.17	6.25	18.75	27.08	14.58	25.0	
Preparing the Patient		f	1	1	1	1	0	5	12	14	7	6	48
		%	2.08	2.08	2.08	2.08	0	10.42	25.00	29.17	14.58	12.5	
Landmarking		f	0	0	1	1	2	10	11	13	6	4	48
		%	0	0	2.08	2.08	4.17	20.83	22.92	27.08	12.50	8.3	
Placing Needle into Patient		f	0	1	0	0	3	8	9	11	9	7	48
		%	0	2.08	0	0	6.25	16.67	18.75	22.92	18.75	14.5	
Injecting Medication		f	0	2	0	0	1	1	14	7	12	11	48
		%	0	4.17	0	0	2.08	2.08	29.17	14.58	25.00	22.9	
Giving Without Supervision		f	1	2	0	3	5	12	12	6	3	4	48
		%	2.08	4.17	0	6.25	10.42	25.00	25.00	12.50	6.25	8.3	

APPENDIX 24

Self-Efficacy Scores on Seven Components of the M.I. Procedure
Prior to Final Injection (Form A)

		Scale (1-10) Frequencies and Percentages										
Components	Unable To Do	Low 1	2	3	4	5	6	7	8	9	High 10	Cases
Calculating Dose	f %	0 0	0 0	0 0	0 0	3 6.52	2 4.34	6 13.04	10 21.74	12 26.09	13 28.26	46*
Drawing up Medication	f %	0 0	0 0	0 0	0 0	1 2.17	2 4.34	6 13.04	12 26.09	11 23.91	14 30.43	46
Preparing the Patient	f %	0 0	0 0	1 2.17	0 0	0 0	4 8.70	16 34.78	5 10.87	15 32.61	5 10.87	46
Landmarking	f %	0 0	0 0	0 0	1 2.17	2 4.34	7 15.22	13 28.26	7 15.22	11 23.91	5 10.87	46
Placing Needle into Patient	f %	0 0	0 0	0 0	0 0	2 4.34	3 6.52	9 19.57	13 28.26	10 21.74	9 19.57	46
Injecting Medication	f %	0 0	0 0	0 0	0 0	1 2.17	1 2.17	5 10.87	9 19.57	13 28.26	17 36.96	46
Giving Without Supervision	f %	0 0	1 2.17	1 2.17	3 6.52	2 4.34	6 13.04	11 23.91	7 15.22	12 26.09	3 6.52	46

*Missing Data: Two students failed Nursing 320.

APPENDIX 25

Comparison of Students' Outcome Expectations Before and After Giving IM Injections

Student	Outcome Expectations Before Giving Injections	Outcome Expectations After Final Injection
#1	- hand sweating probably able to do it - it might hurt	- will go better
#2	- that med will go in and there won't be any problem - I won't hit an artery or vein or anything	- expect it to go well - keep in mind that if I hit a nerve I am in trouble
#3	- that the patient can't feel it, but realistically there will be a bit of pain - sigh of relief	- patient doesn't feel too much pain - hopefully no blood drawn up - patient will feel better afterwards
#4	- not professional, rather shaky. There will be a lot of areas that will need to be improved with practice	- overall good - I feel confident - more relaxed
*#5	- think it will be okay - will be prepared for it	- be fine, don't see any problems
#6	- expect patient to still be living - that it will go well	- adult - go fine child - hesitant
#7	- everything will work out, hopefully	- think it will go okay
#8	- expect some pain is involved - will have learned a new task	- pretty well

#9	- I think I'll be able to do it, do it good. - I'll be nervous but not so that I can't do it. Hopefully the patient will think it is good.	- go well
#10	- quick and not painful	- good
#11	- probably will mess up somewhere in one of the steps	- good, I think I can do them pretty well
#12	- probably nervous but not to extent that would be incapable. Do it fine with minor adjustments to technique	- be good - everything will go fine
#13	- I'll be pretty nervous - relief of getting it over - if patient doesn't yell I'll be all set	- I think I can do it - looking forward to doing them on my own
#14	- probably go alright - immense relief - patient glad to get it over	- okay - I think I'll be alright and can do them by myself
#15	- patient will say it hurts - over quickly - don't break the needle	- confident can get job done - will remember all the steps
#16	- feel relieved and excited - feel good all over - instructor and patient will probably feel relieved	- go well

#17	- a bruiser - I hope not. - Hope it will be okay and I'll have enough information to do it properly	- FAILED Nursing 320
#18	- "I'm a star" - will be nervous	- pretty well; pretty good
#19	- that I'll be able to do everything right, not shaking - calm and confident about what I'm doing - patient won't feel too much pain	- good
**#20	- able to do it	- good
#21	- end up okay; will work out - shaking, will need to steady myself, no major difficulty once I have learned	- great - has done lots on my own
#22	- think it will work out	- go okay but I'll be nervous
#23	- everything will go okay -- I don't know	- good - have done some on my own
#24	- expect it to be good	- will go very well
#25	- hopefully it will be alright - 80% correctly done, miss one little thing	- good - no problems

#26	- hopefully no one will scream - be fairly positive - do task okay - don't put anyone in major pain	- good
#27	- I think that when I go to give it I will stop - prick the patient	- will be okay
#28	- do all right (depends on preparing with reading, demo, practice) - won't be too proficient - not as painless as future ones will be	- quite well
#29	- that patient won't feel too much pain - able to prepare them for it - very nervous but can control it - hopefully won't slip	- quicker, more confident - feel better about how well I drew it up - feel good about it
#30	- hopefully good, feel good about it - patients won't jump or anything	- with kids, its hard to say - with adults, expect it to be good, expect to be nervous
#31	- looking forward to it - I think I'll feel good	- go fine
#32	- going to be pretty nervous - slow at doing it, not going to make a mistake - double check - patient will be nervous	- feel good about them - doing them on my own - good, wonders if patient is anxious about a student doing the injection

#33	- I think I'll be able to do it - might not be as smooth and efficient as later - might hurt patient more than later ones	- go very well
#34	- to feel how it feels from this end - don't expect it to hurt the other person	- fine except for deltoid site or subcutaneous - look for patient's reactions first
#35	- not able to give it - hope able to get needle in without the patient jumping	- good
#36	- not the greatest but don't think I'll kill the person	- still a bit anxious about it, but it will go okay
#37	- hopefully good - goes well - hope it doesn't hurt the patient	- good
#38	- hopefully have it measured out - don't want hands to be shaky or patient to feel more pain than usual - plan to distract them	- FAILED Nursing 320
*#39	- success depends on patient and how nervous they are and how much they hate needles	- it will go fine - no problems
#40	- successful	- will do very well

#41	- second to give - feel like I'm hurting the person - they might say I did hurt them	- good
*#42	- think it will be okay - some problem with calculating dosage and with locating proper site	- go well
#43	- won't be that bad - others give them	- go fine
#44	- correctly, comfortable - has observed it being done	- usually goes fine, but concerned with landmarking
#45	- think it will go really well	- expect it to go really well
#46	- hope it works out well with little pain to the other person - hope I do everything right	- okay, no problems - only problem is if it is a new site
*#47	- hopefully the patient won't scream and yell - go alright - feel pretty confident	- quick and easy to do now - don't even think twice about it
#48	- I expect that I better do it right	- to be doing it correctly with a few minor promptings

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* Given previous injections to humans.
**Given previous injections to animals.

APPENDIX 26

Comparison of Administration Score (Injection #2) with Giving Previous Injections

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between groups	2	1970.69	985.35	8.96	.0005*
Within groups	45	4949.79	110.0		
Total	47	6920.78			

*Indicates significance of 0.05 level

SCHEFFÉ PROCEDURE

Mean (in percent)	Group
53.50	2 - previous injection given to animals
83.43	0 - no previous injection given
90.50	1 - previous injections given to humans

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly different from Group 1 at the 0.05 level.

NEWMAN-KUELS PROCEDURE

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly different from Group 1 at the 0.05 level.

APPENDIX 27

Comparison of Equipment and Recording Score (Injection #2) with Giving Previous Injections

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Squares	F-Ratio	F-Prob.
Between Groups	2	3653.44	1826.72	6.51	0.003*
Within Groups	45	12620.48	280.46		
Total	47	16273.92			

*Indicates significance at 0.05 level.

SCHEFFÉ PROCEDURE

Mean (in percent)	Group
41.50	2 - previous injections given to animals
84.98	0 - no previous injections given
86.50	1 - previous injections given to humans

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly different from Group 0 at the 0.05 level.

NEWMAN-KUELS PROCEDURE

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly diff~~erent from Group 0 at the~~ 0.05 level.

APPENDIX 28

Comparison of Total Score (Injection #2) with Giving Previous Injections

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Square	F-Ratio	F-Prob.
Between groups	2	1105.35	552.67	8.65	.0007*
Within groups	45	2875.90	63.91		
Total	47	3981.25			

*Indicates significance at 0.05 level.

SCHEFFÉ PROCEDURE

Mean	Group
63.50	2 - previous injections given to animals
85.55	0 - no previous injections given
91.50	1 - previous injections give to humans

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly different from Group 0 at the 0.05 level.

NEWMAN-KUELS PROCEDURE

*Group 2 is significantly different from Group 1 at the 0.05 level.

*Group 2 is significantly different from Group 1 at the 0.05 level.

APPENDIX 29

Comparison of Administration Score (Injection #3) with Giving Previous Injections

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Square	F-Ratio	F-Prob.
Between groups	2	320.76	160.38	2.98	0.0610
Within groups	45	2422.90	53.84		
Total	47	2743.67			

SCHEFFÉ PROCEDURE

Mean	Group
76.50	2 - previous injections given to animals
87.12	0 - no previous injections given
92.00	1 - previous injections given to humans

No groups are significantly different at the 0.05 level.

NEWMAN-KUELS PROCEDURE

*Group 2 is significantly different from Group 1 at the 0.05 level.

APPENDIX 30

Comparison of Time Taken to Administer Final Injection with Giving Previous Injections

ANALYSIS OF VARIANCE

Source	D.F.	Sum of Squares	Mean Squares	F-ratio	F-Prob.
Between groups	2	18.81	9.41	6.42	0.0037*
Within groups	42	61.50	1.46		
Total	44	80.31			

*indicates significance at 0.05 level

SCHEFFÉ PROCEDURE

Mean (in minutes)	Group	
2.00	0	no previous injections given
3.50	1	previous injections given to humans
4.50	2	previous injections given to animals

*Group 0 is significantly different from Group 2 at the 0.05 level.

NEWMAN-KUELS PROCEDURE

*Group 0 is significantly different from Group 1 at the 0.05 level.

*Group 0 is significantly different from Group 2 at the 0.05 level.